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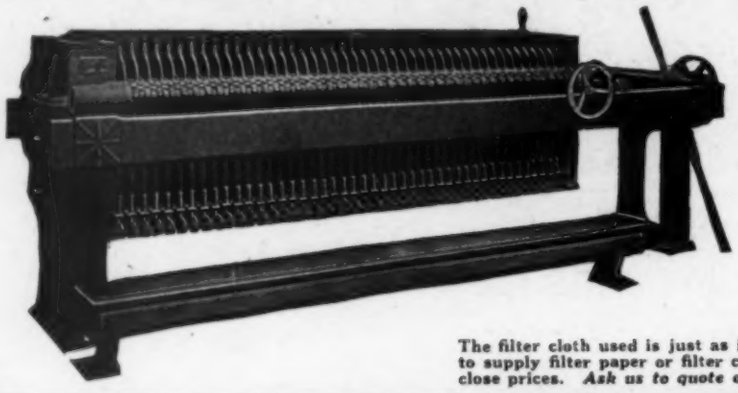

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Looking a Gift Horse in the Mouth

OF THE important announcements made at the Pittsburgh meeting of the American Chemical Society none received more popular approval or wider publicity than that of the gift of an annual prize of $25,000 by the Allied Chemical & Dye Corporation. It is to be awarded to that American chemist who, in the opinion of a proper committee, has done most for the advancement of chemistry. The applause that greeted the announcement in Council meeting found an echo in the daily press throughout the length and breadth of the land. But during the remainder of the week the prize was a topic of frank discussion that belied the sincerity of the enthusiasm with which its announcement apparently was received. The general tenor of the conversation was, "The prize is a great thing for American chemistry, but——."

It is proverbially bad taste to look a gift horse in the mouth, but in this particular instance we think that comment is fairly invited. The organization of the Allied Chemical & Dye Corporation was a fine industrial conception. But events would seem to indicate that under the leadership and control of EUGENE MEYER, ORLANDO WEBER and their fellow syndicate members there has been a more abiding interest in finance than in chemical industry. The lack of chemical understanding and chemical sympathy at the top have found expression in the wrecking of research organizations and the emasculation of companies as far as chemists are concerned. Wholesale reorganization involving the discharge of employees from office boys to presidents has extended even to the removal from the list of aged pensioners who have given their lives to their employers. The policy pursued has, moreover, disturbed the morale of the remaining technical employees to a point where they have neither respect for their employers nor pride in their jobs. That they continue to do their work to the best of their ability is only a matter of self-respect.

It is conceivable that after pursuing this policy to a point where it has alienated the interest and friendship of the chemist, the corporation should now seek to gain his favor. But it will require atonement in other ways than by the gift of a cash prize to wipe out this blot on the 'scutcheon of American chemical industry. Of course the offer will be accepted and the prize awarded through the medium of the American Chemical Society, and undoubtedly the money will be joyfully accepted by the fortunate recipient, despite the fact that some have said they would scorn it, while others would devote it to the support of cast-off pensioners. The prize is a fine gesture, but it is not a convincing argument that the financial leadership of American chemical industry has been converted.

The Coal Industry On the Carpet

"I DO NOT believe great solutions are to be found out of emotional denunciations, but out of sober scientific examination," said HERBERT HOOVER to the chemical salesmen last week in discussing the coal industry in the United States. In his opinion, a sober, scientific examination of the coal industry by a national coal commission fully empowered to get at the bottom of the trouble is the plan that offers the greatest opportunity for constructive work since the war. Three times in recent years the coal industry has reduced the country to a point of industrial collapse because of a shortage of elementary and vital raw material. When an industry cannot so regulate itself as to avoid such impasses it is time for the public to step in and protect its interests through Congressional legislation.

The trouble with the coal industry is patent. It has a capacity of about 800,000,000 tons per year, whereas the maximum consumption is only 500,000,000 tons. Even in years of boom there are 200,000 surplus miners in the industry, and the average employment time is roughly 60 per cent, not counting strikes. Thus the public has to pay for 40 per cent idleness. The nation is forced to permit miners to live according to a standard out of proportion to their services, and that on only 60 per cent of productive work. In other words, the problem of the coal commission will be to develop some method whereby properties can be liquidated and miners turned into other industries, in order that the cost of the commodity may not be exorbitant. The overhead of the industry must be cut down. All this must be accomplished with an adjustment that shall be fair to employer and employee, but it should not be an impossible task.

Pittsburgh Entertains American Chemical Society

JUST as Milwaukee undoubtedly has claims to fame that were not wiped out by the adoption of the Eighteenth Amendment, so Pittsburgh would be perpetuated in the minds of chemists even if the reformer succeeded in placing a ban on the familiar stogey. Certainly the 1,300 chemists who registered at the Pittsburgh meeting of the American Chemical Society would be the last to forget the scientific excellence as well as the lively hospitality of the Pittsburgh Section.

One finds a peculiar spirit of co-operation and emulation among these chemists of the Smoky City. Due to the large number of industries centering in Pittsburgh there are groups of chemists, each of which is at once a competitive but co-operative unit in advancing the chemical industry. We are told that this spirit not only finds its expression in the annual outing and field day of the section, but that it is also a large factor in de-

veloping that quality of humanity that takes the curse off the cold scientific character of the profession.

Those who were responsible for the program of the Pittsburgh meeting showed rare judgment in one or two respects. In the first place, the formal dinner was abandoned for the more delightful sociability of a garden party and outdoor theatrical performance. Second, the smoker was enlivened by the fact that the various numbers on the program were performed by members of the local section. Evidently when it comes to making fun, the Pittsburgh Section "rolls its own." Without showing partiality, we think the skit prepared by the chemists of the Aluminum Co of America deserves special mention, and we hope to publish it later as a contribution to the lighter vein in which chemists sometimes indulge.

The general and technical sessions had the customary interest for those in attendance. As usual the programs were entirely too long and many of the 457 papers were unworthy of a place in the list. Among the divisions and sections reporting good programs and good attendance were those devoted to rubber, cellulose, leather, petroleum, and industrial and engineering chemistry. For some reason or other the division of fertilizer chemistry was poorly attended—a delinquency that should be remedied if the division is to satisfy what is admittedly a large field of industrial chemistry. Perhaps less attention to methods of analysis and more to the broad problems of the industry will develop a strong division.

On the whole, the Pittsburgh meeting was one of the best that has been held and the Pittsburgh Section is entitled to the thanks of the visitors for the excellence of the arrangements.

Two Shifts and Three Shifts in Steel

A LARGE amount of information and opinion is accumulating on the question of the iron and steel industry eliminating the two-shift system of operation, where employed, in favor of a universal three-shift system. To the various studies made in past years there have now been added two long reports presented respectively by BRADLEY STOUGHTON and HORACE B. DRURY at a meeting September 8 of the executive board of the American Engineering Council of the Federated American Engineering Societies. Further, pursuant to the recent suggestion of President HARDING, a committee of the American Iron and Steel Institute is also at work on the subject.

The investigators find it necessary to consider the matter from many viewpoints. Even the barest outline of the subject cannot be given in this column. The momentary mental attitude of labor is a matter of importance. There is the question how many of the foreign born might become restless with an 8-hour day and seek 12-hour employment. Then there is the question of attracting classes of men who do not now gravitate toward blast furnace or steel mill employment. A point brought out in one of the reports now available is that with the introduction of more machinery the peak loads of activity, involving necessary rest periods, are reduced.

The literature thus far has been prepared chiefly by engineers and men who may in a sense be called social workers. The views of strictly business men will no doubt be incorporated in the report to be made by the American Iron and Steel Institute. From the business viewpoint, there seems to be good reason for making an effort to change from the two-shift to a three-shift system as soon as possible. Obviously the change must be made some time. Costs, wage rates and selling prices are in a particularly unstable condition now, hence less disturbance is promised than might prove to be the case later. Wage rates were declining sharply in 1921, while on the first of this month a 20 per cent advance went into effect in the industry. The price of one finished steel product or another sometimes changes several dollars a ton almost over night. There was much unemployment last year, while of late there has been a decided labor shortage at many plants. Nothing being at all fixed, changes can now be made better than at other times.

One suggestion has been made that deserves particularly careful consideration. It is that the man might be given the same hourly rate as formerly, whereby he would receive two-thirds as much per day, but with a bonus attached according to performance of the unit at which he is employed, whereby his weekly earnings might prove as large as formerly if not larger. This is a very attractive subject. A veteran in the iron and steel industry who recently retired from an important position after many years of service, a man noted for initiative, has often expressed the opinion that "payment by results" could be made to work in the iron and steel industry. He has insisted that some plan could be devised that would eventually prove practicable. Here is an opportunity to try the principle. Two changes would disturb conditions no more than one, so that there would be a chance to kill two birds with one stone.

Why Chemists Leave The University Laboratory

NOT long ago we commented editorially on the inequality in remuneration which exists between professional and industrial work. We were glad to sponsor the plan suggested by a good friend that there be established fellowships with unusually high remuneration—"to save the exceptional man for educational work." That is, however, only half of the story. A single incident from many will illustrate the other side.

A young professor of analytical chemistry was doing unique and recognized research. His apparatus, such as he had, was begged and borrowed from friends and foundations. His department supplied him with almost nothing. In addition for his analytical course he had sixty platinum crucibles for over a hundred men. These crucibles were loaned to students by the day and had to be returned to him personally each night to be locked in the safe (by order of the department head). Not only did his department give him no funds for research but it filled his time with meaningless routine that was irksome and useless.

This same man subsequently accepted an industrial offer which, incidentally, paid him more than double the salary; but, more pertinent to the immediate question, it gave him unlimited funds for equipment, almost unlimited assistance and complete freedom from the mechanical routine of even ordering apparatus.

The moral back of the tale is this: Industry has a much better appreciation of the intrinsic value of the research man's time and energy than is found in the university. It relieves him of elementary routine, pays him for the quality of his service and gets value received. The job is attractive not only because it pays better, but also because it is free from onerous red tape.

A chemist of parts is not apt to enthuse over a position, in a university or elsewhere, which consumes a part of his time in work that a high school boy would scorn. It is evident that universities may well look toward a housecleaning that will remove the millstones of routine and red tape from the necks of able chemists. Perhaps then the lure of industry and even the shaking of the moneybags will fall upon the deaf ears of the man whose creative impulse is being satisfied.

Mass Production of Fundamental Data

SO RAPID has been the advance in the science of metallography that it now embraces far more than is indicated by the derivation of the word. It now embraces the science and art of metals and metal working. Its present importance is only another instance of how modern industrial life has eagerly adapted to its uses the principles discovered by precise physical and chemical experimentation.

Despite the fact that its practitioners devote much of their time to determining the strength, hardness or electrical characteristics of metallic samples, it is unquestioned that rational generalizations are often possible only if proper consideration be given to the constitutional or equilibrium diagram of the alloy system in question. Conversely, a correct diagram is an indispensable guide for a systematic investigation of the possibilities of any alloy series thought to contain members of commercial importance.

As yet we know surprisingly little about these possibilities—due in part to the comparative youth of the science. Excluding those rare metals which are only laboratory curiosities, there are about 600 possible binary systems of the thirty-five or forty fairly common metals. Of these not more than a dozen have been exhaustively studied, and perhaps a hundred are mapped out with fair accuracy. The general outlines of many more have been sketched, but at least 150 have not been touched! Many thousands of ternary systems are possible, and virtually all this field is untrod by the systematic researcher. Quaternary systems—but why continue?

It would be interesting to inquire into the origin of such work as has been done on equilibrium systems. French scientists proposed the principal investigative apparatus, but the Germans have done most, perhaps 80 per cent, of the detailed work. Russian effort has been confined to simple systems. PARRAVANO and his Italian followers have done some splendid work on ternary systems, chiefly of theoretical importance. It has remained for the English to explore a number of binary and ternary systems of great commercial importance, bringing to bear various methods of research in a penetrating examination—in great contrast to the very sketchy, almost hasty, work which characterizes the German publications.

Nearly all of these nations have done more than America. Disregard a large number of careful researches on commercial alloys of narrow composition, and there is little left of a sytematic nature. Perhaps we should not be unduly criticised for thus "skimming the cream." The rewards attending commercial work have been so great that in the past the Americans could afford to let others spend years of patient labor on theoretical problems, while we could apply their conclusions to shop practice.

Bear in mind, however, that practice rapidly adapts theory, and continuous and advanced investigation is essential for technical progress. Hence the importance of intensive work on equilibrium diagrams. We venture to state, though, that if Americans will ever take up the work which perforce has been dropped by Germans and Russians; if Englishmen of ability can be persuaded to continue their searches with the same minute care as before, it appears that some of the principles of mass production must be introduced into the laboratory. Certainly it is of no advantage to stop a tension machine every few seconds to read extensometers, when a movie film can automatically record the entire history of a continuous test, for study at leisure. Like statements are true of thermal analysis, magnetic studies and determinations of a wide variety of physical properties.

A revival in interest in the fundamental diagrams of physical metallurgy therefore seems to await the successful design or combination of instruments of fair precision which work almost automatically. Such a "machine" should contain a furnace chamber approaching black body characteristics, capable of being heated and cooled at definite rates. Its gaseous atmosphere should be under control, and the metallic samples contained therein so connected with auxiliary apparatus that autographic records of various kinds may be drawn simultaneously. All that would be necessary would be to insert the sample, fix the films or charts, and close the switch!

Many of the elements of such a machine are already known. It certainly would be well worth while for some of our institutions possessing good instrument shops to assemble such of them as are available, and to design and construct the necessary auxiliaries.

A New Viewpoint For Labor and Capital

THE typical cartoonist loves to depict a struggle between two huge and ferocious wrestlers—one labeled Capital and the other Labor—while off at one side stands a timorous little figure, afraid to interfere lest he be hurt yet obviously apprenhensive as to his fate should either win—the General Public.

Now the cartoonist may be trite in showing things in this way; but, unfortunately, he is almost always correct. It is almost the universal practice for both sides of an industrial controversy to act as though they alone were concerned. This attitude continues as long as the public at large will stand for it, and it is only when the force of opinion drives our administrators to the verge of drastic action that the rights of the great (or is it little?) third party receive the consideration which they justly should receive.

It is then with feelings of more than relief that we note the recent message of W. G. LEE, president of the Brotherhood of Railway Conductors, to his followers. Mr. LEE points out that there is an amount of damage to the public beyond which capital and labor must not go in their controversies; for, if they do, then the government must, to protect the very life of the nation, conscript their services and force them to fulfill their so necessary functions.

This fact has often been pointed out before. But coming at the time they do and backed by the force of his position, Mr. LEE'S words cannot fail to help drive home to both parties to industrial strife that their wishes alone cannot be the only guide to their actions, and that they must, if they would retain their present independence, consider the effect of these actions on the whole nation.

Report of Sixty-fourth Meeting, Sept. 4-8, 1922 — Council Meeting — Addresses at General Sessions— Abstracts of Technical Papers Presented at the Industrial, Physical and Inorganic, Fertilizer, Rubber, Sugar, Dye and Petroleum Divisions, and Educational, Historical, Cellulose and Leather Sections

EDITORIAL STAFF REPORT

THE Pittsburgh meeting was a good one. It was well attended, the registration running just over thirteen hundred. The provisions made by the Carnegie Institute of Technology were convenient and agreeable, and, as has been the case with every meeting held under the presidency of Dr. Smith, things have gone forward with a certain *cachet* of style, of grace, of dignity, that invariably reflected the captain-general of the hosts.

There were not many startling discoveries noted among the 457 papers presented. That of greatest general interest was probably Thomas Midgley's demonstration of his observations on accelerating and retarding catalysts in the combustion of petroleum hydrocarbons. The rest was, generally speaking, good average, with some peaks.

$25,000 Prize Announced at Council Meeting

The Council of the Society met on Monday afternoon at 3 o'clock in the ballroom of the William Penn Hotel, with President Edgar F. Smith in the chair. In opening the meeting he announced with great pleasure an annual prize of $25,000 donated by the Allied Chemical & Dye Corporation, to be given as a reward to the chemist in the United States who, in the opinion of a proper committee, shall have done most to advance the science of chemistry in the world. It is to be initiated in 1923, and to continue perpetually. The donors desired that a committee should be formed to consist of Dr. Smith and four others to be chosen by him, and this committee is to formulate rules and to organize the first jury of award. This jury is to consist of seven members, of whom five shall be appointed by Dr. Smith's committee and two shall be appointed by the donors; these two, however, are not of necessity to be men connected or associated with the corporation. The prize is available to workers in all fields of chemistry, and to include teaching as well as research.

It was resolved that a special committee draw an appropriate minute of the Society's acceptance and appreciation of this great gift.

Invitations were presented from the San Francisco and Milwaukee Sections to hold the fall meeting of 1923 respectively at San Francisco and Milwaukee, and on vote it was decided to accept the invitation of Milwaukee. It was resolved at the Birmingham meeting in April to hold the spring convention of April, 1923, at New Haven.

Approval was given to a plan for international editorial supervision and control of the *Journal of Physical Chemistry*, hitherto published by W. D. Bancroft, whereby the magazine will be published jointly by the Chemical Society (London) and the American Chemical Society. Neither organization is to be financially responsible for the publication of the magazine, the necessary expense being defrayed by an annual gift of $10,000 by the Chemical Foundation.

The editors of the Society's various journals and the secretary were re-elected. Prof. W. A. Noyes was re-elected editor of the scientific monographs, but Prof. John Johnston wrote that his other pressing duties compelled him to resign from the editorship of the technological monographs. A vote of thanks to Professor Johnston for his admirable work already done was passed and the advisory committee of the Society was delegated to appoint his successor.

The treasurer reported that, owing to reduced costs of paper and printing, he hoped, for the current year, to keep the expenditures of the Society within its income.

Research by Corporations

At the spring meeting in Birmingham action was taken on a motion of Dr. Harold Hibbert to make public the names of those firms and corporations that are supporting research or scholarships at various universities and colleges. Accordingly it was noted that the Grasselli Co., Fleischmann & Co., R. G. Carr of Chicago, the Monsanto Chemical Co., Antoine Chiris & Co., the General Bakelite Co., the Corning Glass Co., the Public Health Institute of Chicago, the du Pont company, the National Lime Association and many others were so engaged. Arrangements were made to obtain and publish a more complete list.

The subject of student members was discussed at some length without any definite action, except that it was recorded as the sense of the Council that the student rate be not increased. These pay $10 a year instead of $15. There are about 1,300 such members of the Society now, and the number of student applicants from Germany and Japan has materially increased of late.

After the meeting the members of the Council re-

paired to the Duquesne Club, where on invitation of the Pittsburgh Section they were guests at dinner. A number of prominent men of Pittsburgh who were not members of the Council were also present. At the close of the dinner short speeches were made by the toastmaster, James O. Handy, who is chairman of the Pittsburgh Section, and the following on whom he called: E. M. Herr, president of the Westinghouse Co., Charles H. Herty, E. R. Weidlein, E. E. Slosson, H. E. Howe, J. E. Teeple, Wilder D. Bancroft, Ellwood Hendrick, and finally as a kind of a cordial and friendly doxology, the president, Dr. Smith.

The General Meetings

The general meeting was called to order by J. O. Handy, chairman of the Pittsburgh Section. After a few introductory remarks, the customary felicitous addresses of welcome were made by S. H. Church, president of the Carnegie Institute, Dr. John G. Bowman, chancelor of the University of Pittsburgh, and Dr. Thomas S. Baker, acting president of the Carnegie Institute of Technology.

Mr. Handy then handed over the meeting to Dr. Edgar F. Smith, who with historical reminiscences and delightful allusions to ancient days, to protons and electrons and to Pittsburgh, the Imperial Daughter of the West (the speaker being first, last and always a Pennsylvanian) he introduced Dr. Charles L. Parsons, who told informally of his tour abroad this summer. He spoke of the International Conference at Lyons, which was its third annual meeting, of the seventy-five delegates present, and of the usefulness of the work carried on by the conference. There is full co-operation among the representatives of various nations. The hospitality dispensed was supreme. Of course the barrier of mixed languages sometimes brought out strange suggestions. Thus, at the formal banquet at the close of the sessions, the official interpreter translated from French into English, and had printed on the invitations, the memorandum as to evening dress in the following words: "Come in your night clothes."

Dr. Slosson's Speech

Following Dr. Parsons came Dr. E. E. Slosson of Washington. We are informed that Dr. Slosson's speech will be printed in full in the *Journal of Industrial and Engineering Chemistry*, and we commend it to our readers as an illuminating discourse on the status of the chemist today. Space forbids us to give more than a few disconnected quotations from his talk that are indicative of the whole.

For instance: "One hundred years ago chemistry was a poem. Today it is a tool." "All sciences earn their own living when they get old enough." "Some want to keep science as a sport, and many fear that the chemist may lose his amateur standing if he makes any money." "The chemist is the greatest coiner of words in the world. Nobody has had such a job since Adam named the animals." "The law of Malthus has been often refuted but never repealed." "Whenever any process is thoroughly understood it is found to belong within the field of physics or chemistry." "The new atom is composed mostly of vacuum with a few algebraic symbols." "The great problem of chemistry is that of combustion. Every tiny grass blade points the finger of scorn at the chemists and says: 'See how we do it!'" Apropos of the solemn dictum of the conferees at Washington to the effect that chemical warfare shall not be, it seemed to spring from the resolution by the home government that "the American Army shall never be sneezed at." "Mind is supposed to be immaterial; and yet it possesses inertia."

So much for his flashes. He concluded with an earnest plea for works on chemistry and chemical phenomena told in non-technical language.

Eliminating the "Knock" in the Automobile Engine

The paper of Thomas Midgley, Jr., and T. A. Boyd on "The Chemical Control of Gaseous Detonation, With Particular Reference to the Internal Combustion Engine," was one of broad appeal to the layman as well as to the chemist. It was sufficiently novel to interest the scientist and yet its utility and commercial significance were such as to attract the industrialist.

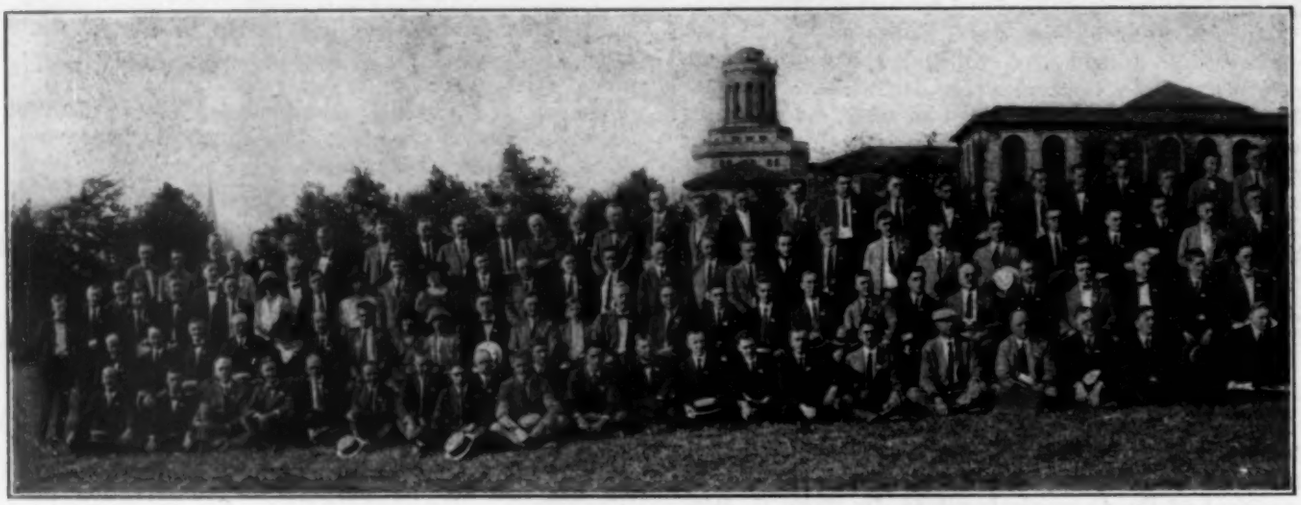
The work of the General Motors Research Corporation has had for its purpose the conservation and economic utilization of motor fuel and this particular study is an outgrowth of the problem of developing a more efficient type of internal combustion engine. Were it not for the phenomenon of "knocking," which is well known to every motorist, the simple change from a low- to a high-compression motor would offer a very effective economy in fuel consumption, for by increasing the compression ratio there is a more efficient utilization of the energy content of the fuel. What is but a commonplace annoyance in the ordinary automobile engine becomes so intensified in the high-compression motor that there is not only a serious loss of power but often an actual damage to the engine parts.

The Anti-Knock Compounds

Midgley's investigations have definitely shown that the chemical composition of the fuel is a controlling factor in causing and preventing knocking. An accidental discovery indicated that the addition of a small quantity of iodine to a gasoline fuel greatly lessened the tendency for a higher-pressure engine to knock. It took 2 years of research to discover a second compound having similar properties and about a year more to discover a third. These researches, however, served as a basis to indicate the general nature of the compounds that would accomplish the desired purpose. They also indicated compounds that have the opposite effect—namely, to increase the knocking.

Most of the compounds that affect detonation are derived from about fifteen elements, of which some of the more important are I, Br, O, N, Se, Te, Sn and Pb. Some typical compounds which have been used are iodine, bromine, oxygen, isopropyl nitrite, aniline, diethyl selenide, diethyl telluride, tetra-ethyl tin and tetra-ethyl lead. Bromine, oxygen and isopropyl nitrite are accelerators and the others are anti-knocking compounds. Tetra-ethyl lead, the best of the compounds now known for this purpose, has about 1,500 times the power of benzene in preventing detonation. Recent investigation has shown nickel carbonyl to be an excellent anti-knock and the indications are that the corresponding compound of platinum will probably be even better.

A splendid demonstration of the efficiency of one of these compounds was effected by the experimental explosion of a small quantity of acetylene in a glass apparatus at atmospheric pressure. The addition of but one part of diethyl selenide to 800 of acetylene was sufficient to reduce the loud crack of the acetylene-air explosion to an almost inaudible puff.



But what was perhaps the most striking exhibit was a high-pressure gas engine, completely installed on the lecture platform. By means of a special apparatus[1] connected to the engine cylinder it was possible to measure the detonating characteristics of the fuel. An electric light was so arranged in the circuit that as the knocking increased or decreased the lamp would burn brightly or dimly. When the engine was started and operated with ordinary gasoline a decided knock was distinctly audible throughout the hall. But true to predictions, a benzene fuel mixture did not cause knocking when used under exactly the same conditions. A gasoline fuel that knocked badly ceased immediately after very small amounts of the vapors of iodine or diethyl selenide were permitted to enter the breather of the motor. Similar demonstrations were made to show the efficiency of the other compounds, particularly of the tetra-ethyl lead mixture, which has already attained some commercial significance through its use in airplane and motor-boat engines.

These compounds, however, have not as yet been placed on the market, according to Mr. Midgley, for their full benefit cannot be derived until gas engines have been redesigned to operate at higher compression. The anti-knock compounds give little or no additional energy to a given volume of fuel, so that with the ordinary motor their use will not increase the mileage per gallon of fuel.

The most important aspect of these discoveries from the scientific viewpoint is the increased knowledge and new insight into the theory of catalysis.

Chemical Journalism

E. J. Crane, the editor of *Chemical Abstracts*, had chosen for the subject of his paper "The Journal Literature of Chemistry." He contrasted the exactness with which the scientist accumulates his data with the loose, indefinite and often careless language sometimes used for its presentation. Prof. Wilder D. Bancroft followed Mr. Crane's address with an informal but cleverly illustrated talk on structural colors in feathers. Those who will recall his paper at the Rochester meeting on "Blue Eyes and Blue Feathers" will appreciate the intensely interesting nature of the latest of the good doctor's hobbies.

[1]This is the so-called "bouncing-pin" method described by Midgley at the Birmingham meeting of the A.C.S. See *Chem. & Met. Eng.*, vol. 26, No. 16, p. 735, April 19, 1922, and *J. Ind. Eng. Chem.*, vol. 24, No. 7, pp. 587-93, July, 1922.

Dr. Teeple on the Potash Industry

Dr. John E. Teeple was introduced as the man who made an industry, and this he promptly denied. Industries are never created by individuals but by co-operation of a group, each carrying out his function. Potash from Searles Lake was an industry moving slowly about 3 years ago, badly crippled by empirical work badly carried out. The process was sent back to the laboratory for repairs and a set of solubility curves and precipitation diagrams was developed by which it has been possible to increase yields and obtain consistent yields. An intelligent comprehensive investigation includes economic and sales study as well as chemical investigation. This latter should proceed in five steps: Research laboratory work, large-scale laboratory work, small-scale plant (experimental), single unit plant, full-size equipment, large-scale production. Dr. Teeple traced the potash industry through some of these steps and ended by discussing personnel—the difficulty of obtaining a chemically trained man with executive balance.

President's Address

The people of Pittsburgh were the specially invited guests at the session in Carnegie Music Hall on Wednesday evening, when President Smith delivered his address on "Our Science." In a way which is distinctly his own, Dr. Smith held the interest of a large and appreciative audience, who were treated with a brilliant review of the subject nearest our leader's heart—chemistry in America, its history and development.

Cellulose Section

Perhaps it was the stimulus due to the permanent establishment of the division as such that aroused the unusually enthusiastic discussions before the Cellulose Section. The attendance was large and representative, and the technical program was well balanced, including papers of interest to the pulp and paper, viscose and wood-distillation industries and a number of lively discussions on the all-important question of the structure of cellulose.

This latter debate took the form of a symposium on Wednesday afternoon. Dr. Louis Wise presented the views on the subject developed by the work of W. C. Russell and himself at Syracuse University, contending that the structure of cellulose from wood and cotton is the same and offering a hypothesis to explain the prop-

erties and products of cellulose which are generally construed as contrary to this view. E. C. Sherrard expressed opposing views based on the experience of the Forest Products Laboratory. The symposium was conducted by Harold Hibbert, chairman of the division, to whom must go much credit for the lively sessions which have characterized it.

Pulp and Paper Problems

One of the most interesting papers presented was a summary of the research problems in the pulp and paper industry by Edwin Sutermeister, which was read by Dr. Hibbert. The author emphasized the need of the closest co-operation between the research men and the industry if the most value is to be obtained from research. He named as the outstanding research problem the determination of the chemical constitution of cellulose, so that processes may be based on sound principles instead of guesses and empiricism. The nature of hydrocellulose and oxycellulose also needs more attention. More accurate methods of determination and separation should be devised and the extent of their harmful effect on the paper determined. Mr. Sutermeister then took up the problems of each step in paper manufacture by the sulphite and soda and sulphate processes, in bleaching, sizing, bating and coating special papers.

Another talk of interest to paper men was given by Harold S. Davis and described a new apparatus in which the humidity and temperature are easily controlled and in which the changes in dimensions of different samples of paper may be measured under varying conditions. This device is of practical importance in the manufacture of printing papers where the expansion or contraction between imprints may cause blurring.

The rosin sizing of paper was discussed by Alfred Tingle in two papers read by Dr. Hibbert. The reaction between aluminum sulphate and sodium resinate has been studied, and it has been found that when solutions of these compounds are mixed in stoichiometrical proportions, precipitation of alumina and rosin is complete. When a considerable excess of aluminum sulphate is used, the precipitate contains no resinate, but consists of free rosin acids with less than their equivalent of free alumina. At certain concentrations all the alumina remains in solution, rosin acids only being precipitated. Rosin acids precipitated in this way—Rosin B—are not in the same physical condition as when precipitated by mineral acids. Addition of mineral acids to this modification of rosin changes it to the more common form—Rosin A. Rosin B is probably spongy rosin very thoroughly interpenetrated with water. As commonly carried out, the reaction in the beater results in the deposition of rosin in the form of Rosin B on the fiber with less than its equivalent of alumina. Most or all of the remaining free alumina is precipitated as the result of subsequent dilution. That alumina plays no essential part in the sizing is shown by the fact that paper can be sized successfully under conditions such that no alumina can be deposited.

Adsorption of Salts by Cellulose

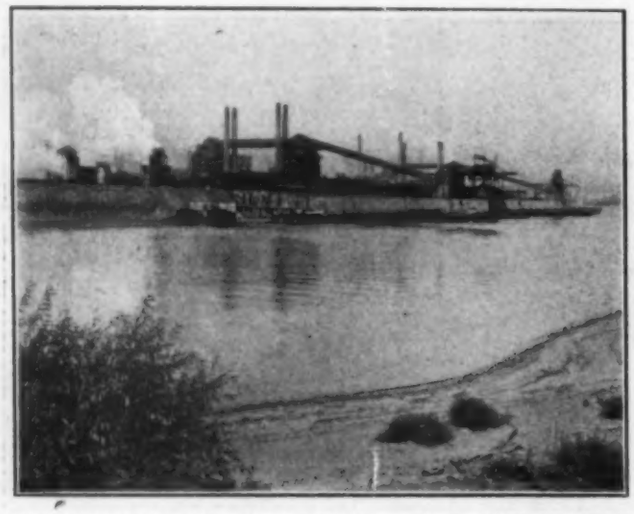
A most animated discussion was aroused by the symposium on the adsorption of salts by cellulose, which was opened by Wilder D. Bancroft. The significant phenomena in this connection were grouped by Dr. Bancroft under four classes of salts—miscellaneous salts, acids and bases, mordants and substantive dyes. H. B. Williams discussed the action of neutral salts on cellulose, particularly the peptization of cellulose by certain thiocyanates. H. N. Holmes expressed the opinion that the salts present in wood ash are absorbed in the plant and so retain their identity when the wood is ignited. An example of this is the presence of iodine in seaweed. Considerable discussion was aroused on the nature of the action of caustic soda on cotton and the general opinion of those present crystallized into the opinion that this action is one of adsorption rather than chemical combination.

No reports were ready from the committees on analytical methods and on standard cellulose. G. J. Esselen, Jr., reported for the viscosity committee, which submitted specifications for a standard falling sphere viscosimeter which were tentatively adopted and are to be tried out for a year in actual operation and if satisfactory, permanently adopted.

G. J. Esselen, Jr., was elected chairman of the division, with L. E. Wise vice-chairman and L. F. Hawley secretary.

Chemical Education Section

The Section of Chemical Education, of which President Smith is chairman and Prof. Neil E. Gordon is secretary, convened Wednesday morning in one of the largest lecture rooms of the Fine Arts Building, and there was standing room only. It is a very earnest group and those in attendance included eminent teachers who are the true links in the great chain of chemical advancement, old professors with a genius for teaching



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whose pupils fill outstanding chairs and occupy outstanding posts in science the world over, young professors with minds quick to sense ideas and to put them to use, and occasionally there are teachers who indicate their vain search for an easy formula for the practice of this most difficult of all the arts.

Pandemic Chemistry

"Pandemic Chemistry" was the first subject, presented by Prof. Wilder D. Bancroft, and it impressed us as the most important paper. He outlined a full course of lectures designed for students who are not majoring in this subject, and also for the general public. It is a course *about* rather than *of* chemistry. The first half-dozen lectures have to do with general principles and important processes and with illuminating experiments, after which he takes up various occupations and industries, and demonstrates the chemical basis of each. It might also serve as a school for the directors of corporations engaged in chemical industry, for goodness knows they need it! We are informed that Professor Johnston plans to establish a course along somewhat similar lines for the benefit of Yale students, while Professor Bancroft is hoping to be in a position to inaugurate such a course at Ithaca.

High School Chemistry in Correlation With College Chemistry

The second paper, by L. W. Mattern, had to do with high school chemistry and its correlation with college chemistry. It is desired that they shall not overlap and that they should be co-ordinated so as to provide for continuous advancement. Right here is where Professor Bancroft's pandemic chemistry is also indicated. The old question what to do with high school chemistry in college will not down. Some colleges require it; others don't. Most of them don't. Then, for freshman chemistry some divide the students into groups of "elementary" and "advanced," which is seldom satisfactory because many of the "advanced" students who have had high school training are not equipped for the advanced course. The discussion ran on for considerable time, and finally a committee of seven was resolved upon to present a report at the New Haven meeting in April. But it stands to reason that a boy who has been taught *about* chemistry in a secondary school will have a better sense of the subject and its scope and meaning than if he has had an inadequate course in the beginnings of chemistry without the vision.

In the afternoon of Wednesday a symposium was held on premedical, dental, pharmaceutical and agricultural chemistry teaching. Prof. J. C. Krantz, Jr., of Maryland State College gave a clear outline of the difficulties of teaching chemistry to pharmacists, and the way to meet them. If pure chemistry is taught, the students are likely to lose interest and study only in order to pass, whereas if the teaching is applied too closely to pharmacy they are disposed to bone up on business and to neglect the underlying theory. He finds that, by setting beacon lights along the way, indicating occasionally the applications of general principles to their prospective work, their interest may be retained and proper study encouraged. Prof. Charles W. Cuno concluded with a paper on "Qualitative Analysis for Engineering Students," and the question was raised whether it was worth while or not. The speaker proposed a course in the chemistry of materials as a substitute.

The Intelligence Test and Freshman Chemistry

Thursday morning Professors Jacob Cornog and Edward Bartow of the State University of Iowa gave a paper on "An Experience With the General Intelligence Test in Teaching Freshman Chemistry." There's no getting away from the correlation between high standing in these tests and high standing in chemistry courses. But in order to bring out the widest possible experience in the subject of mental and general intelligence tests in connection with teaching, it is to be made the subject of a symposium at the April meeting. Someone suggested that these tests helped to determine the competence of teachers, for if students of high standing in intelligence generally fail in their studies, the indication is that the teaching is defective.

Professor Silverman of the University of Pittsburgh reported a remarkable agreement between mental tests and the classification of students. The faculty is not informed of these records until the students have demonstrated themselves. He expressed the hope that some kind of examination along these lines might help to weed out the incompetents at the end of the first semester.

History of Chemistry Section

The Section on the History of Chemistry met in the Fine Arts Building on Thursday. This is Dr. Smith's ewe lamb, and Dr. C. A. Browne of New York and Prof. Lyman C. Newell of Boston University are his fellow shepherds. They are far from being alone in their enthusiasm for this distinguished and cultural side of chemistry, but they are the leaders. Being also active collectors, they have the goods. President Smith left the Educational Section to present two monographs here—viz., on James Curtiss Booth, Chemist, and the Bishop of Llandaff, with a handsome copperplate portrait, his works in four volumes, and an autograph letter.

Dr. C. A. Browne of New York told of John Winthrop, Jr., the first Governor of Connecticut, who was a close friend of Robert Boyle and a fellow member of the Royal Society. He was a chemist of parts, and practiced healing; although not as a physician. Professor McKee of Columbia showed some Dutch cartoons of Van't Hoff. Professor Newell showed letters of Sir Humphry Davy and diplomas signed by John Dalton, and Anton R. Rose showed an unpublished letter of Berzelius to the worthy burgomaster of his town in regard to silk culture.

Division of Fertilizer Chemistry

The Division of Fertilizer Chemistry met on Wednesday, with F. B. Carpenter as chairman and H. C. Moore as secretary.

Fertilizer Analysis Discussed

Many analytical methods for fertilizer testing were discussed. Special emphasis was laid upon the discussion of the Lindo-Gladding method for potash determination in mixed fertilizers as reported by F. B. Carpenter. This method is reported to give results from 0.25 to 0.4 per cent below correct under many conditions, with corresponding injustice to the manufacturer, who naturally desires credit for all of the available potash present. The recommendation of the author that acid be used in solution of the fertilizer to make free all of the available potash was by vote of the division referred to the referee of the Association of Official Agricultural Chemists. It is the hope of this division that the referee on potash may give further attention to this matter and recommend to the A.O.A.C. appropriate action on this erroneous procedure which has been continued for some years despite the fact that attention previously was called to it.

Variation in determination of insoluble phosphoric acid in acid phosphates was discussed by W. R. Austin, who emphasized the discrepancy caused in results from different laboratories by the failure to wash the precipitate thoroughly on the filter with water. In order that variation of commercial significance may not be incurred, it is recommended that a standard sample be included with every lot of tests run so that discrepancies resulting from variations in procedure or unsuspected changes in reagents may not go unnoticed.

E. W. Magruder reviewed methods for determining nitrogen in fertilizer and the discussion resulting made clear the wide variation in practice in commercial laboratories which doubtless is the cause of much of the commercial controversy over valuation of shipments.

Roughly quantitative methods for detection of ten groups of nitrogen-containing compounds were described by G. H. Buchanan of the American Cyanamid Co. The qualitative scheme presented is modeled after the ordinary schemes of inorganic analysis, provision being made for interference of the more common fertilizer constituents which may be present. The ten forms included in the scheme are: ammonia and its salts, cyanamide, hydrocyanic acid and its salts, dicyandiamide, guanidine and its salts, guanylurea and its salts, nitric acid and its salts, thiocyanic acid and its salts, thiourea, and urea.

Influence of Soil Colloids

The replacement of plant food adsorbed by the hydrogels of ferric and aluminum oxides was discussed by Flenner, Lichtenwalner and Gordon, who made careful physicochemical studies of the quantity of plant foods held by these materials. They conclude that the gels hold these materials by selective adsorption, as the material is not washed out, but is subject to replacement as would be expected from adsorbed material. The application of this to soil chemistry was discussed by Wiley and Gordon in another paper on "Can Plants Use Salts Adsorbed by Soil Colloids?" Plants were permitted to root and grow in soils artificially prepared with the maximum adsorption of the various salts used in plant nutrition work. The conclusion is reached that both potash and phosphate are readily available to the plant from the adsorbed form on the gels.

Concentrated Fertilizers Recommended

W. H. Ross, of the Bureau of Chemistry, presented a further discussion of the advantages and limitations of concentrated chemical fertilizers, showing the methods followed by the Bureau of Soils in the study of the problems of how to make a complete concentrated fertilizer from ammonium phosphate, potassium phosphate, ammonium nitrate and similar combinations in various proportions. The need of further research in this problem was emphasized. It was pointed out that the bureau desired not to replace those fertilizers now used but rather to facilitate wider use of fertilizers by development of the concentrated forms, permitting the use of new sources at lower cost and the transportation of materials at less expense to points distant from the source of the materials.

Fertilizers and Plant Composition

The relation of fertilization to plant composition was discussed by H. A. Noyes, who presented experimental data on extended tests in fertilizing grape crops. He showed that from the ratio of the composition from various parts of the plant to each other one can determine the optimum fertilizer use for the specific soil in question.

Utilization of Waste Products for Organic Nitrogen

The afternoon session was opened by a paper written by E. H. Armstrong and read by the secretary, entitled "Utilization of Waste Products for Organic Nitrogen." This paper had to do with the use of such materials as wool waste, leather, hair, shoddy and other nitrogenous materials as fertilizer base. Much of this material was imported from Europe formerly and now it is made here. It goes under the trade name of tankage and contains from 8 to 11 per cent ammonia. Considerable objection used to be made to the material because it smelled of leather waste and some legislation was enacted in various quarters against its use. There exists also a considerable loss in nitrogen content because of the method of treatment.

Special Symposium

The special symposium was begun with a paper by the secretary of the section, H. C. Moore, on the "Modern Trend of Chemical Control in the Fertilizer Industry." Mr. Moore outlined the achievements of chemical control in the three divisions of the fertilizer industry—namely, sulphuric acid, acid phosphate and commercial fertilizers. Some of the triumphs of chemical control in the commercial fertilizer department are not so well known. For example, it has been found possible to select suitable proportions of available material for fertilizer mixtures so that they will not become hard in the bags nor rot the material of which the bag is made.

J. E. Breckenridge followed with a discussion of "Modern Trend of Legislation in the Fertilizer Industry." A number of points were emphasized in this paper: First, the widespread legislation which has been necessary to tax the industry for inspection revenue. Second, legislation against inert nitrogen, and in this, as in most other legislation, the co-operation between the industry and the legislature has been complete and

hearty. Inert nitrogen is, of course, something which is of no earthly good to the consumer and shows up as nitrogen in some analyses. The industry has been alert always to co-operate with the legislature against fraudulent representation of nitrogen content. Specifications are required in most states for mixed fertilizer and in these the details of the specifications must be very complete and according to a prescribed form. Some states legislate that available nitrogen be 60 to 75 per cent soluble, but the legislation on this point is not consistent or even vital. The author pointed out that legislation against special materials was unnecessary, inasmuch as the general fertilizer legislation prohibited the use of any materials injurious to plants and therefore it would be quite foolish to legislate additionally against a specific kind of injurious substance. Mr. Breckenridge finally registered a slight protest against the grading of fertilizer as inferior, passed and good, since the method of analysis did not warrant the so-called "passed" classification, which has a range of only 5 per cent. Two other papers in the symposium were read by the secretary, the first by P. S. Gilchrist on the trend of modern fertilizer plant construction, and the other by E. H. Armstrong on modern trend in fertilizer plant operation.

Division of Sugar Chemistry

The Division of Sugar Chemistry was called to order by Dr. F. W. Zerban, the vice-chairman. The secretary, Frederick Bates, had arranged a thoroughly live program. H. Z. E. Perkins brought to the attention of the section the increasing importance of hydrogen-ion determination as a method of refinery control. Like every other business, chemistry has its fads, and now it is hydrogen-ion concentration. As applied to refinery control there are several points of great interest in the use of the method. The chief use of acidity control occurs early in the process of refining. After washing, the sugar goes through the main process of clarification, bone black decolorization and crystallization without material change in ionization. Many byproducts are formed that are unstable and ferment quickly. Furthermore, they are treated with desiccating agents to complete their destruction. The ionization at these various points is variable, being the resultant of several factors, natural and artificial. The main products of sugar refining are easily tested by means of color indicators, since they are light in color and easily crystallized. With a potentiometer the results are uncertain and sluggish. The byproducts of the main refining operation are dark colored and therefore cannot be tested by means of color reactions. They seem, moreover, to respond somewhat better to electrometric tests. The paper should be regarded as a preliminary report on the subject, but shows clearly that at certain points in the refining operation hydrogen-ion control will be extremely valuable.

Dr. Jackson Confirms His Position on the Clerget Constant

Dr. R. F. Jackson of the Bureau of Standards read a paper on "The Invertase Value of the Clerget Constant." The results given in the paper gave conclusive support to Dr. Jackson's position in this moot question, but inasmuch as there was no one to take the opposite side of the question the paper received none but favorable comment during the discussion.

A paper by F. W. Zerban ably confirmed the earlier work of Dr. Peters on the comparative color determination in cane sirup and molasses. The author showed conclusively that solutions must be filtered through an asbestos layer before carrying out color determinations. Filter paper is not satisfactory, solutions remaining cloudy. This is an extremely necessary correction in procedure.

W. D. Horne described the Vallez rotary filter press and J. F. Brewster brought to the attention of the meeting a vacuum pan for laboratory use.

A New Theory of Char Efficiency

Dr. C. E. Coates discussed activated vegetable chars in some detail and advanced a theory as to the probable reason for the greater decolorizing power of activated material. Activated chars are made from many raw materials, notably lampblack, rice hulls, pine and cypress waste, lignite, bagasse and cane waste. Many experiments show that good char can be made by heating the raw material from 800 to 950 deg. C. with sufficient air to cause considerable surface combustion. A series of analytical results were presented showing that the decolorizing power of a given char varies inversely with its hydrocarbon content. This is an extremely important advance and will lead us a long way toward a proper understanding of the best method for preparing good char. Dr. Coates outlined a simple method of obtaining a cheap char from cane trash.

Inasmuch as it was shown that the hydrocarbon content of char and the decolorizing power have a quantitative and inverse relationship, we are led to a theory as to the cause of greater or less decolorizing power in char. It can be stated that absorption from solution is a selective property of carbon dependent quantitatively on free carbon surface. This surface is wholly or partly covered by hydrocarbon film in chars made without access of air and to some extent by a layer of ash in all chars. The removal of the film by selective oxidation with air and of the ash by means of acid or alkali treatment will expose more carbon surface and increase decolorizing power.

Division of Physical and Inorganic Chemistry

Although apparently we are still distant from a general theory of catalysis, yet there are gradually being accumulated series of experimental results which will be invaluable in the formulation of such a theory when the time comes. That the radiation hypothesis contains elements of truth all who have studied the matter carefully must admit, but whether it is sufficiently general in its application to be regarded as even a first approximation is a matter about which there is still some doubt. Dr. Farrington Daniels after extensive studies of the decomposition of nitrogen pentoxide is inclined to believe that it should be considered in the same way as Berthelot's rule of maximum work, while Dr. Hugh S. Taylor thinks that it is scarcely worthy of any regard. Most people who have studied the matter carefully are waiting for more experimental evidence before either rejecting or accepting this very ingenious hypothesis.

In this connection some studies by Dr. Rodebush of the University of Illinois are not without interest. By the use of statistical mechanics he has succeeded in deriving an equation similar to that developed empirically by Arrhenius for the rate of reaction as a function of temperature. This, combined with the quantum theory, gives a physical basis for Dushman's equation. By the use of a constant characteristic of

every molecule the validity of the equation is extended so that only the most accurate of experimental data had been found to obey the law.

The study of the hydrolysis of mustard gas on cloth is important and it has been found by R. E. Wilson and E. W. Fuller that in a 2 per cent sodium carbonate solution 3 per cent of sulphonated corn oil was remarkably effective in promoting this reaction. The acid formed by the hydrolysis coagulates the oil into which the mustard gas dissolves and then on stirring the oil drops are carried up into the solution of alkali, where they are again peptized, leaving the mustard gas to be reacted upon.

Catalysts and Catalysis

Taylor and his students, working on various reactions involving contact catalysis, have observed numerous interesting phenomena. Carbon monoxide reacts very differently with copper oxide than does hydrogen. In the reduction by either substance the rate of reaction is slow until a red spot of copper is set free. As the red spot grows in size the reaction is accelerated, suggesting autocatalysis. The same thing also holds for the decomposition of a large number of substances such as calcium carbonate, hydrated salts, silver oxide, etc. R. E. Wilson in the discussion checked this up with the phase rule where the presence of the two phases in intimate contact is required for a truly stable equilibrium. At the point of contact there are different electronic configurations which seem to be important in the mechanism of this reaction. This is also probably part of the explanation of promoter action.

The use of kieselguhr as a support for the important catalyst nickel has been very effective. Hydrogen is adsorbed on the supported material to a much greater extent than on the unsupported. The temperature at which the unsupported material has been reduced is very important; for instance, nickel hydroxide unsupported when reduced at 300 deg. is much more effective than when reduced at 500 deg., but when the material is spread on kieselguhr the temperature of reduction has apparently very little effect. The amount of hydrogen adsorbed by a given sample of nickel varies with the pressure for very low pressure, but soon reaches a maximum depending on the temperature. As much hydrogen is adsorbed at 25 mm. as at 750 mm. at room temperature, according to A. W. Gauger and H. S. Taylor.

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A study of the rôle of hydrogen ion in the catalysis has been made by H. W. Close under the direction of H. S. Taylor, and it has been found that the unhydrated hydrogen ion was the effective agent. On dissolving a lactone in ether with 0.1 mol of hydrogen chloride the hydrolysis increased with the addition of water until with an ether solution saturated with water the rate was several hundred times as great as with a water solution saturated with ether, although the electrical conductivity of the latter was the greater. In the ether solution the water aided ionization. There was enough water to produce ionization but not much hydration.

Colloids

E. C. H. Davies read an interesting paper on the effect of gravity, which was small, and of light, which might be great, on the formation of Liesegang bands. When water passes through iron pipes, due to corrosion small amounts of ferric hydroxide hydrosol remain in the water. Filtration through sand will not remove all of the iron. Sulphates and phosphates, added in sufficiently small amounts to be harmless to the water, are not effective in removing this colloid, but with the use of about 0.06 per cent hydroxyl ion the best removal of iron is obtained. Larger amounts repeptize the hydrosol. A convenient method is simply to filter the water through magnesium oxide and then the coagulated iron will deposit on iron sheets. These interesting facts have been obtained by Robert E. Wilson and P. S. Clarke of the M.I.T. Research Laboratory of Applied Chemistry.

A very interesting new and valuable emulsifying agent was described by Harry N. Holmes and D. H. Cameron. *Gum dammar*—be sure to accent the last syllable—is insoluble in water but soluble in many other liquids, aiding in the formation of emulsions of the water-in-oil type where water is the dispersed phase. Such emulsions are more stable and may be made even richer in water than by the use of calcium soaps. By dissolving the gum in a little benzene and mixing into vaseline or heavy oil, salve-like emulsions can be obtained with water. Printer's and lithographer's inks, paints, varnishes and greases can often be greatly cheapened in this way and the properties of the products are frequently better than those of the water-free substance. The use of this emulsifying agent has already been patented.[1]

To obtain a dilute silica gel quickly Lloyd Reyerson and W. T. Morin add ammonia cautiously to the acidified water glass till barely neutral to litmus. A solid gel of half a per cent of SiO_2 may be obtained in this way, while a 2 per cent gel sets almost instantly.

Miscellaneous Papers

At very low temperatures hydrogen chloride and nitric oxide form an intensely purple liquid with a conductivity of 10^{-3} at 130 deg. K., according to Rodebush and Yntema. When the transference numbers of mixtures of sodium and potassium chloride were determined by Schneider and Braley, it was found that sodium had a net transference of zero, suggesting part of the sodium going into a complex anion. By the use of electrometric titrations simultaneously Conant and Fieser and LaMer and Lillian Baker have studied the potentials and energy relations in the reduction of numerous quinones. With a glass-stopped siphon it is possible to obtain reproducible results. Mack and Villars have found that

[1] U. S. Pat. 1,410,012, March 21, 1922.

urease not only aids in the formation of urea but also decomposes it till an equilibrium is reached. R. W. Ryan is studying the tracks of alpha particles through gases under the direction of W. D. Harkins. Silverman and Saunders have studied the formation of ozone from oxygen inclosed in a Berthelot tube.

Anderegg and Bowers describe a new form of discharge obtained by creepage over the surface of various dielectric materials which may have notable influence on the results partly due to the change in the nature of the discharge and partly to be ascribed to the catalytic action at the surfaces. Conclusions are drawn by Anderegg and McEachron after several years of work that the complicating effects of the container walls on chemical reactions in the corona may be more or less serious depending upon conditions and may in some cases cause a complete change in the nature and products of the reaction.

In the study of iron corrosion by water it seemed desirable to R. E. Wilson and D. H. Cameron to study the hydrogen-ion concentrations of buffer solutions at elevated temperatures. This was accomplished after some experimental difficulties with the hydrogen electrode, and the results indicate that there is a slight tendency to shift toward the neutral point. Indicators were found to have similar small shifts of the order of one- or two-tenths of a p_H, so that it may be stated that buffer solutions and indicators are fairly constant up to the boiling point of water.

Leather Section

The meeting of the Leather Section opened with a contribution from Dr. Edmund Stiasny, director of the Institute of Leather Chemistry at the University of Darmstadt, dealing with modern problems in leather chemistry, particularly the chemical nature of collagen, the mechanism of bating and the astringency of vegetable tannins.

Mechanism of Unhairing

In a series of experiments by John Arthur Wilson and Guido Daub, the effects of unhairing by sweating, lime liquors and caustic sulphide liquors were followed microscopically. The action of the sweating process was found to be very similar to that obtained when using an excess of lime with 0.7 grain Na_2S per liter. In both case the cells of the Malpighian layer of the epidermis first separate from the derma and from each other and then liquefy, so that the rest of the epidermis, the hair and the sebaceous and sudoriferous glands are completely separated from the derma and can then be removed mechanically. A decidedly different action was noted with the straight sulphide process using a 2 per cent solution of Na_2S. The protruding portions of the hair and the corneous layer of the epidermis were attacked rapidly, almost complete removal of these being effected before the alkaline solution has penetrated to the depths of the hair bulbs. Consequently when this method is employed the hair bulbs are usually found intact in the finished leather.

Pancreatin as an Unhairing Agent

Some of the fundamental factors in the enzyme process of unhairing were determined by John Arthur Wilson and Albert F. Gallun, Jr. When calfskin is swollen in dilute caustic soda, neutralized with sodium bicarbonate and then put into a suitable solution of pancreatin at 25 deg. C. exposed to air, the hair is completely loosened in 24 hours, but the action is not due to the enzyme, since it is checked by covering the solutions with a layer of toluene. At 40 deg. a solution of pancreatin fails to cause a loosening of the hair of fresh skin (not previously swollen) because the corneous layer of the epidermis is impermeable to the enzyme layer below. When a skin has previously been swollen by acid or alkali, and the corneous layer rendered softer and more permeable, a solution of pancreatin at 40 deg., even under toluene, will not only destroy the Malpighian layer of the epidermis and loosen the hair but it will also dissolve the elastin fibers of the skin, thus effecting both unhairing and bating in a single bath.

Plumping

Two other papers by Wilson and Gallun dealt with the subject of plumping. When the variation in degree of plumping of calfskin was plotted against hydrogen-ion concentration expressed as p_H, two points of minimum plumping were found, one at 5.1, the other at 7.6. From available data, it would seem that these two points represent different forms of skin protein, one stable only in acid solution and the other in alkaline solution.

In the course of this work a convenient method of measuring the degree of plumping was developed. The fact that the tanner tests the skins by pinching, since the resistance of the skin to compression is a measure of the plumping, suggested the use of a thickness gage similar to those used for rubber. The thickness of a given portion of skin is read off on the gage after a fixed time and the ratio of this result to that obtained on the same portion under standard conditions at a p_H of 8 is taken as the degree of plumping. As the instrument is easy to handle, measurements may be made right in the tannery.

Fixation of Tannin by Hide Substance

The fixation of tannin by hide substance was considered from many angles. Wilson and Kern showed the effect of hydrogen-ion concentration upon the analysis of vegetable tanning materials.

The per cent of tannin found by the A.L.C.A. official method increases with p_H value to a maximum at 8 and then decreases rapidly toward zero. On the other hand, p_H value appears to have no effect upon the determination by the Wilson-Kern method over the range 3.6 to 7.3, but the rate of tanning of hide powder decreases rapidly with increasing p_H value above 7. The rate of filtration of tan liquors is markedly affected by change of p_H value, which may be attributed to changing degrees of dispersion of some of the solid matter. The addition of lime to tan liquors causes a precipitation of tannin, but only at p_H values above 7.2.

Wilson and Kern also studied the stability of the hide-tannin compound at different p_H values and found that leather is resistant to washing in neutral or acid solutions, but is broken up into protein and tannin by alkaline solutions. The decomposition begins at p_H = 7.7 and proceeds at an increasing rate as the p_H value is raised above this value.

Continuing earlier work on quebracho and gambier, Miss Margeret W. Kelly determined the concentration curves for hemlock, larch, oak and wattle extracts. Using the modified Wilson-Kern method for determining the amount of tannin fixed, all these extracts gave the quebracho type of curve. Miss Kelly also studied the effect of hydrogen-ion and time factors. Fixation is possible on both acid and alkaline sides, the curves showing maxima at p_H values of about 2 and 8, with a

minimum for low concentrations at about 5. With increased time, the minimum at 5 and the maximum at 8 tend to disappear.

Data on the influence of neutral salts were presented by Arthur W. Thomas and Miss Kelly. The results obtained were shown to be due to two effects proceeding simultaneously but independent of each other—the decrease in the dispersion of the tannin with added salt and the increased activity of the tannin due to the hydration of the added salts. In the case of NaCl, the second factor predominates until a concentration of 2 M is reached, beyond which the influence of the first factor is felt. The work is to be continued using $CaCl_2$ and non-electrolyte such as sugar.

Further work by the same authors indicates that there is a difference between tanning fixation on one side of the iso-electric point and that on the other. Between 20 and 25 per cent of the tannin fixed by gelatine at p_H 3 and 5 can be removed by extracting the precipitate with water, whereas practically none can be extracted from the precipitate obtained on the alkaline side. In discussion, Mr. Wilson pointed out that if the character of the leather differs on either side of p_H 5, which is the concentration usually found after bating, then this point is a most critical one.

Dr. Thomas and Alexander Frieden found that the optimum mutual precipitation of gelatine and gallotannic acid took place at p_H 4.4 to 4.6. The optimum points for vegetable tannins were found to vary from 3.5 for gambier and oak to 4.0 for larch, hemlock and quebracho and 4.5 for wattle. At these points the sensitivity of the gelatine: salt test is greatly increased.

Electrophoresis experiments by Dr. Thomas and Stuart B. Foster demonstrated that vegetable tannins are amphoteric, the change in the charge of the electrical particles occurring between p_H 2 and 2.5.

Chromic Solutions

On the basis of electrophoresis experiments Frank L. Seymour-Jones concludes that a negatively charged complex may not be present in certain liquors which do tan. Further consideration of the complex nature of chrome liquors was given by the same author in a paper reviewing the disputed question as to whether the liquor contains colloidally dispersed chromium oxide or basic salts.

Other Papers

Charles S. Hollander described experiments comparing the action of artificial bates with dog manure as used in goatskin puers and with chicken manure as used for calfskin.

Color measurement of vegetable tan liquors was considered by R. O. Phillips and L. R. Brown.

Since free sulphuric acid is not the only objectionable material in synthetic tans, Dr. S. Kohn made a study of the solvent action of various syntans on tanned hide powder. Even at the same p_H the action of different syntans varied considerably.

Gelatine Symposium

Dr. Jacques Loeb's paper on "The Interpretation of the Influence of Acid on the Osmotic Pressure of Protein Solutions" was read by Dr. C. E. Davis.

When osmotic equilibrium is established between a solution of casein and hydrochloric acid inclosed in a collodion bag and an outside aqueous solution free from protein, the hydrogen-ion concentration is always greater in the outside solution than in the casein solution. The observed osmotic pressure is accounted for quantitatively by the difference in concentration of hydrochloric acid in the two solutions, without taking into consideration any possible osmotic pressure of the casein itself. The observed potential difference between the two solutions in millivolts always has the numerical value equal to 59 times the difference in p_H value between the two solutions at 24 deg., proving that the inequality in p_H value is determined by Donnan's equation for membrane equilibria.

Three papers on the program originated in the research laboratories of the Eastman Kodak Co. Dr. S. E. Sheppard presented a very comprehensive study of the characteristics of the plunger type of jelly strength tester and showed how the results obtained with this type could be referred to the twist type as standard.

In a second paper the anisotropic swelling of thin sheets of gelatine was discussed. The swelling was found to be a function of the type of gelatine used. S. S. Sweet worked with Dr. Sheppard in developing the data upon which these two papers were based.

F. A. Elliott read a paper in which Dr. Sheppard and Miss A. Benedict were co-authors, dealing with the preparation of gelatine free from ash and hydrolytic decomposition products. A 5 per cent gelatine solution is electrolyzed for 2 to 3 weeks, then poured into an equal volume of purified acetone. The precipitate is removed, heated to 60-70 deg. C. and made up to a 10 per cent solution, which is cooled on a chill table and dried. The product contains 0.01 to 0.03 per cent ash.

A paper by E. Bateman and G. G. Town was read by Mr. Town. Three series of studies relating to the moisture content of glue were made. In the first, curves were obtained showing the relation between humidity and moisture content, and an exponential equation was developed which holds better than the adsorption isotherm. Second, the tensile strength was shown to drop rapidly as the moisture increased, falling below the value for wood at about 30 per cent moisture. Third, mold growth was found to require 32 per cent or more of moisture, but as the strength is very low in this region, this effect does not become a factor unless the glued material is stored without strain at high humidity.

In conclusion, Wilson and Kern called attention to a curve giving two points of minimum swelling of gelatine, at p_H 4.7 and 7.7. The second minimum is probably the iso-electric point of the sol form of gelatine while the first is that of the gel form.

Election of Officers

Officers for the ensuing year were elected as follows: Chairman, John Arthur Wilson; vice-chairman, Charles S. Hollander; secretary, Arthur W. Thomas; executive committee to consist of officers and C. R. McKee and F. P. Veitch.

Section of Gas and Fuel Chemistry

Initial sessions of the Section of Gas and Fuel Chemistry were held under the chairmanship of Dr. A. C. Fieldner of the Bureau of Mines. The first meeting was given over to a symposium on combustion, at which Prof. R. T. Haslam, W. K. Lewis and others reviewed the physicochemical fundamentals of this subject. Of the fifteen general papers presented at the later sessions, five related to such basic considerations as the constitution of coal and its relation to carbonization and combustion. Technical abstracts of these and other important papers given before this section will be published in a subsequent issue of this magazine.

Division of Petroleum Chemistry

Each successive meeting of the new Petroleum Division is marked by an increasing attendance and a very evident desire to incorporate within this organization all of the varied interests of the petroleum chemist. The change from a section to a permanent division of the Society had been authorized at Birmingham, subject to final approval by the Council of a set of bylaws to be submitted. Unfortunately, a slight indefiniteness in outlining the scope of the division made it necessary for the Council to return these bylaws to the division for amendment and the Council's approval was postponed until its next meeting. In spite of this handicap, however, the work of formulating a business policy, electing officers, etc., proceeded without other delay.

The proposed constitution and bylaws were read by the secretary, Dr. W. A. Gruse, and each section was approved by the meeting. The only change was made in the opening paragraph, which was so modified as to show clearly that the Division of Petroleum Chemistry did not consider within its scope the preparation of standard testing methods and specifications—work which is now adequately handled by A.S.T.M. Committee D-2 and similar agencies.

The following officers were nominated and elected to serve until the meeting in September, 1923: T. G. Delbridge, chairman; Ralph R. Mathews, vice-chairman, and W. A. Gruse, secretary. The executive committee consists, in addition to these officers, of W. F. Faragher and E. W. Dean.

Vapor Pressure and Volatility Measurements

The first two papers to be presented were by R. E. Wilson and his co-workers in the Research Laboratory of Applied Chemistry, Massachusetts Institute of Technology. D. P. Barnard, 4th, discussed the continuation of the work of the Co-operative Fuel Research Program in measuring the effective volatility of a dozen or more motor fuels. Distillation curves were shown for various straight runs and special blends. From the data presented it is possible to draw certain generalizations as to the effect of the shape of these curves on the effective volatility of the fuel in so far as it affects the completeness of vaporization and proper distribution in the manifold.

It was pointed out in the second paper, by Wilson and Wylde, that a knowledge of the vapor pressure of volatile solvents, such as benzene and hexane, dissolved in various types of relatively non-volatile oils is of commercial importance in a considerable number of applications. Of these, the three most important are (*a*) the dilution of crank-case oils with fuels in internal combustion engines; (*b*) the complete renewal of volatile solvents from oils and fats obtained by the solvent extraction processes; and (*c*) the recovery of solvents by scrubbing with cold absorbent oils, as in benzene recovery from coal gas.

The work described in this paper makes it possible to calculate approximate figures for three general types of volatile hydrocarbons—paraffine, naphthene and aromatic—dissolved in most ordinary types of oil.

Molecular weights were determined on all of the oils used, and the amount of vapor pressure lowering for different combinations was compared with the theoretical as predicted by Raoult's law. It appears that the amount of lowering produced by different types of combinations is fairly definitely predictable and that the results for any combination met with in practice can be calculated with satisfactory accuracy for any ordinary temperature if the vapor pressure of the pure volatile constituent is accurately known, together with the molecular weight and type of hydrocarbons present in the oil.

BENZOL PLANT AT CLAIRTON WORKS

Decolorizing Efficiency of Fullers Earth

Leon W. Parsons and L. R. Churchill described a rapid test for determining the decolorizing efficiency of fullers earth. This is based on the vigorous reaction of this earth with pinene to form polymerized products with the development of a very large amount of heat. This temperature rise serves as a convenient and practical measure of the efficiency of various clays as decolorizing agents, provided the reaction is properly controlled. This paper discussed the mechanism of the reaction, the materials used and the application of the test for laboratory and plant use.

Professor Parsons also reported on the progress of his work with Brian Mead in studying the effect of certain properties of emulsifying agents on the stability of oil-water emulsions. It will be recalled that Nujol was used in building up synthetic systems comparable with commercial mineral oil emulsions. It has been found, among other things, that several common emulsifying agents give abnormal results with regard to the type of emulsions produced. This observation has an important bearing on the mechanism of the behavior of soaps and finely divided solids as emulsifying agents.

Engine and Road Tests

The engine experiments reported by Dr. Carl O. Johns of the Standard Oil Co. of N. J. were an attempt to answer the question: Do higher sulphur fuels cause trouble in Diesel motors? Several fuels were tested to ascertain the effect of both free and organic sulphur. This included high-sulphur Mexican crude and gas oils and also a polymerized byproduct from alcohol manufacture containing about 19 per cent of combined sulphur. These were mixed in proportion to give a sulphur content of 10 per cent in the fuel mixture. The Diesel engine was run for about 400 hours at a compression of 500 lb. Another run was made with a kerosene containing 0.85 per cent of free sulphur in solution. Frequent examinations of the dismantled engine disclosed no evidences of corrosion nor was the copper tubing affected appreciably. Some trouble was encountered by excessive carbon formation around the exhaust valve.

Jones and Fieldner, in a paper from the Bureau of Mines, showed the amount of gasoline saved on government trucks after the carburetors had been adjusted by exhaust gas analysis. The adjustments made by

the use of a portable CO_2 indicator gave an increase of over 20 per cent in mileage for the first month after testing and 16 per cent increase for the second month. The average for several thousand analyses from 101 cars showed that after adjustment the completeness of combustion amounted to about 70 per cent.

Prof. Ralph H. McKee exhibited a waxy distillate obtained as an intermediate product in the vacuum distillation of certain oil shales. Usual tests, such as solution in 66 deg. Bé. sulphuric acid, show this product to be highly unsaturated—sometimes as much as 100 per cent. Distillation at atmospheric pressure yields a petroleum containing 48 per cent of saturated hydrocarbons and redistillation brings about additional cracking with a further increase in saturation. In other words, this behavior is apparently the reverse of ordinary cracking, which proceeds with an increase of unsaturated constituents. In the discussion following this paper it was generally conceded by those present that the H_2SO_4 test was without value and that the term unsaturation should not be used, at least without some qualifications.

Refining Petroleum With Hypochlorite

One of the most important papers from an industrial viewpoint was the description by A. E. Dunstan and B. T. Brooks of the use of hypochlorite solutions for refining petroleum oils. This treatment, although often proposed, has usually been abandoned because of the failure to remove chlorine from the finished products. The Anglo-Persian Oil Co., however, has perfected the process and has now entirely replaced the sulphuric acid-caustic soda method in its Persian refineries. The claim is made that gasoline and kerosene are being refined by hypochlorite solutions with losses of less than 0.5 per cent. Malodorous compounds, including sulphur derivatives, are removed and the treated oil is said to be of a very superior quality. The process is carried out in the usual form of treating apparatus and the refining costs are markedly low, especially when polymerization and other losses incidental to acid refining are included in the comparison.

Report of Research Committee

Dr. W. F. Faragher, as chairman of the committee on research appointed at the Birmingham meeting, reported that a study had been made of the comprehensive list of research problems outlined by Dr. Van H. Manning, director of research, American Petroleum Institute, and that the committee had selected a smaller list of problems as the basis for an immediate research program. The following are of the type adapted to co-operative research and are of important and immediate utility to the petroleum industry:

1. Thorough scientific investigation of fractionating columns.
2. Preparation of rational specifications for petroleum products based upon the results of actual research work. More rational volatility specifications for gasoline and tests for the "oiliness" property of lubricants.
3. Investigation as to the actual need of highly refining gasoline for motor fuel; is it necessary to remove bad smelling sulphur compounds completely in order to obtain efficient service from gasoline? Will these compounds injure the engine?
4. A study of the fundamental causes of carbon formation in cylinders; elimination of polymerized products in cylinders; study effect of additions of peroxides, naphthalene, picric acid, phenanthrene, pyrene, picene, cyclohexanol, phenol, etc.
5. Thorough study of lubrication from a colloid chemical standpoint.
6. The chemistry of petroleum hydrocarbons, particularly of the higher homologs.
7. The chemistry of the sulphur, nitrogen and oxygen compounds in petroleum.
8. The chemistry of sulphuric acid refining of oils.
9. The causes and mechanism of color changes in oils.

In a discussion of the committee's report, which was participated in by Dr. Manning and the chief chemists of a number of representative refining companies, it was generally agreed that existing facilities should be utilized in carrying out this research program, but that it should be financed in such a way that its results become the property of the entire petroleum industry.

Lubrication Symposium

A feature of the division's sessions was the symposium on lubrication from the chemist's viewpoint. Prof. C. F. Mabery of the Case School of Applied Science reported the results of his classical study into the fundamentals of petroleum composition, particularly in the fractions that cannot be distilled without decomposition. A second paper on the viscosity temperature curves of fractions of typical American crude oils was presented by Lane and Dean of the Bureau of Mines. The difficulty in interpreting viscosity data at one temperature in terms of viscosity at any other temperature has led to this detailed study over a wide range of temperatures and also to formulating these data in an interpretable form. Dr. Faragher discussed a study made by himself and Ronald Reamer on the frictional coefficients obtained with a Kingsbury oil-testing machine. The symposium was closed with an interesting review by Dr. R. E. Wilson of his published work on the mechanism of partial lubrication.[1]

Division of Industrial and Engineering Chemistry

The Division of Industrial and Engineering Chemistry was called together by the chairman, W. K. Lewis, who at once introduced Dr. L. W. Parsons as chairman of the automatic process control symposium. The first paper, by J. A. Doyle, on the control of industrial heating processes, pointed out that temperature control was only one of the factors in controlling heat, the other was the time factor. In producing a material of given quality and cost, time enters into it fundamentally. Such factors as the surface exposed, the mass, the conductivity rate, the method of applying heat, all affect the time factor. It was well illustrated by a series of diagrams showing where in furnaces of given design the so-called "cold zone" occurs. It was very easy to understand why one furnace would produce material of a different quality than another furnace by simply studying the difference in size and position of this cold zone. The distinct advantage of a continuous process was pointed out in that practically all of the material is subjected to the same kind of conditions and thus quality control is much more rigid and reliable. With batch processes the position in the furnace makes a great deal of difference in the material produced; in other words, material from one part of the furnace will be quite different from the material from another part.

Guy B. Taylor presented a paper on automatic volumetric analysis with particular reference to a carbon monoxide recorder. Dr. A. T. Larson and Dr. Karrer each described some of the control devices employed in high-pressure testing of ammonia catalysts. A machine for automatically controlling the pressure on the catalyst bomb was described in detail and charts for

[1] See *J. Soc. Automotive Eng.*, vol. 11, Nos. 1 and 2, July and August, 1922, and *J. Ind. Eng. Chem.*, vol. 14, No. 8, August, 1922.

its performance were given. It indicated a remarkable performance over a period of days, the pressure holding perfectly constant under operating conditions. The principle of the control was a valve with a core held in place by a stiff spring automatically regulated by means of an electric control. Mr. Karrer's apparatus was a glass pressure gage consisting essentially of a glass diaphragm blown on the end of a tube and automatically recording pressure by means of a bent platinum wire contact. The device must have been quite difficult to make, although the author was modest to the point of disparagement.

The symposium was continued with a survey of the possibility of the recovery of gasoline from natural gas by J. B. Garner. He noted that gasoline content was on the increase in natural gas, it having risen quite appreciably in the last 3 or 4 years. The ideal conditions for absorbing gasoline are under pressure by means of an oil solvent. There seems to be no efficiency at low pressures, and refrigeration is commercially an impossibility. An absorbing temperature of 50 deg. F. for salable gasoline was prescribed. Specifications for the absorbing oil were outlined. It was developed that a paraffine base oil rather than an asphalt base oil gave the best absorbent, and curiously enough a low rate of circulation with high saturation was preferred to a high rate of circulation and low saturation. During the course of a month six volumes of oil were found to be necessary to absorb one volume of gasoline. In the recovery of the gasoline from the oil the gases are first removed, then the oil passes to heat exchangers and finally to gasoline still. There seems to be, in the author's opinion, a fertile field for work along these lines.

The Plastometer Described

Professor Bingham then read a paper on the plastometer as an instrument for process control. He pointed out that many other things were necessary besides chemical control and instanced colloids as an example. For example, what is the difference between a viscous system and a plastic material? Or to put it another way, is the viscosity of a colloidal solution a simple function of the shearing stress? Recent work has shown that this is not the case and that, for example, in a certain paint a change of viscosity of 10 per cent was evident when the shearing stress was trebled. No one class of colloids has this property peculiarly to itself nor is it necessary to have high concentration of the dispersed phase. By the use of the plastometer we can take a material such as paint, which is definitely plastic, and add successive increments of vehicle to the material, measuring each dilution in the plastometer. We then seem to have two well-defined properties, yield value and mobility. Neither of these is quite a linear function of the concentration of solids in the plastic material. One interesting point about the yield value curve is that it approaches a zero value and looks as though we would obtain a concentration of solids which would give zero yield value. This point would be the point at which the material changes from a viscous liquid to a plastic solid. As a matter of fact, the curve bends rapidly toward the zero concentration of solids. A collodial solution will have a definite yield value, whereas a true solution will not. Again, the plastometer offers a method of distinguishing between types of colloids. For example, some colloids exhibit a definite change of properties at a given temperature quite analogous to the melting point of a solid. This is the transition temperature from a plastic solid to a true liquid. Such colloids as glue and nitrocellulose exhibit this property.

Several other papers of interest were presented at the symposium, notably one by Herbert A. Clark on some phases of automatic process control. In it he describes an automatic temperature control with a time control in addition. The temperature was controlled by means of an air diaphragm valve system and over a given time by means of a cam disk on a clock mechanism. Thus a definite temperature can be maintained inside of a kettle or reaction apparatus by controlling the steam input, and this cycle can be repeated at given intervals automatically.

Cost Accounting an Aid in Process Control

The symposium closed with a paper on cost accounting by Charles Wadsworth, 3rd, of *Chemical & Metallurgical Engineering*. The author made a special plea that chemists take up this subject seriously, as executive positions demand a knowledge of it. After discussing the mechanism by which expenditures become cost accounts with the aid of diagrams, the control of production, purchasing and sales by means of costs was outlined. The symposium was then adjourned and the Industrial Division joined with the Gas and Fuel Section in the afternoon at its combustion symposium.

Corrosion of Iron by Natural Waters

The presentation of papers was resumed on Thursday morning, some of the most notable of which we have been able to abstract. Prof. R. E. Wilson presented two papers, one on the removal of small amounts of carbon monoxide from gas streams by passing over granular soda lime, and the second a more notable one on "The Mechanism of the Corrosion of Iron and Steel in Natural Waters and the Calculation of Specific Rates of Corrosion." Professor Wilson first analyzed the chemistry of corrosion and showed that it depended on three reactions. The first reaction was the action of hydrogen-ion on the iron to form ferrous ions and a kind of atomic hydrogen, not gaseous hydrogen nor yet ionic hydrogen. The second reaction was the formation of water from the atomic hydrogen with dissolved oxygen, and the third reaction was the formation of gaseous hydrogen from atomic hydrogen. Obviously the course of these reactions depends a great deal on the hydrogen-ion concentration of the water. If we took extreme cases, the limiting factors of corrosion would vary definitely with the hydrogen-ion concentration. With natural water the second chemical reaction, or the formation of water from hydrogen and the dissolved oxygen in the water, is the controlling reaction. In other words, the amount of dissolved oxygen in the natural water controls the corrosion. With higher hydrogen-ion concentrations, which do not exist in natural waters, other factors enter in and the formation of gaseous hydrogen would be a controlling factor. The fact that in natural waters oxygen diffusion through the liquid layer is the limiting factor can be proved by the fact that the velocity with which the water flows over the corrodible surface changes the rate of corrosion. Professor Wilson suggested a new unit of measurement of corrosion introducing a factor for the oxygen concentration.

Bound up with this same subject was the next paper, by F. N. Speller and V. V. Kendall, in which a method was described for measuring the corrosion of water on iron pipe and an investigation of the effect of velocity

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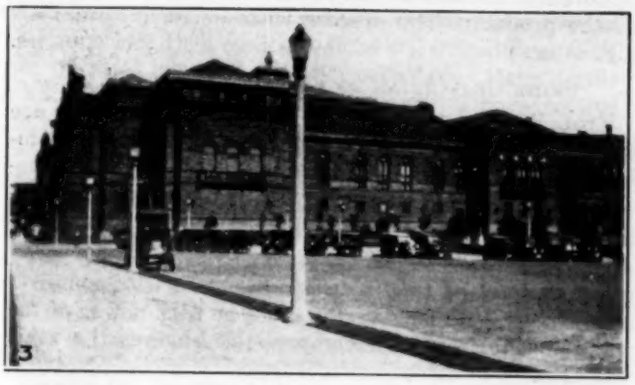


Assembling for Luncheon at the Clairton Works
Carnegie Music Hall
Luncheon Time at Carnegie Cafeteria
Byproduct Exhibit at Clairton Works

Carnegie Institute From Schenley Park
Oak Manor, Scene of the Garden Party
Central Administration Building, Carnegie Institute of Technology
The Steps of Carnegie Music Hall

upon the corrosion. An experimental apparatus in which water was passed through pipes ¼, ½ and ¾ in. in diameter was described and the results were discussed. The method will be applied in future to the effect of the composition of the metal, the character of the water, etc. The method used for measuring corrosion was the decrease in oxygen content of the water before and after passing through the pipe.

A preliminary paper on the action of sodium silicate when used in soap was presented by Dr. A. S. Richardson of Procter & Gamble. It was studied from several different angles, notably water-softening action, detergent action without admixture of soap and effect on the emulsification power of soap. Dr. Richardson pointed out that the soap-sparing effect of sodium silicate varied with the conditions of its use, being pronounced at high temperature and in hard water high in magnesium salts. He went on to say that probably of itself sodium silicate had little detergent action except in so far as there was fatty acid present in the wash. There was some discussion on this point and J. G. Vail of the Philadelphia Quartz Co. exhibited some emulsions made from mineral oils with sodium silicate alone. This seemed to indicate that sodium silicate had a detergent action without any fatty acid being present at all.

A short paper by R. T. Haslam and W. P. Ryan on the counter-current digestion of wood by the soda process pointed out that in a counter-current system the decomposition of the wood was much more even than in the batch process, yielding quite properly a high alkali concentration toward the end of the digestion instead of at the start. Diagrams were presented showing the method by which eight digesters could be used in this system.

Additional data were presented by Paul Poetschke on the physical properties of dental cement. The effect of the rate of hardening and the temperature of hardening upon the ultimate hardness of the dental cement was discussed. An apparatus resembling very much a human tooth kept at the temperature of the mouth was used throughout the experiments so as to reproduce actual working conditions. In general it was found that higher temperatures of hardening gave harder cement, but it would be unsafe to go above 130 deg. or even quite that high in the hardening process, as it would be extremely painful and might injure the tooth.

Cheap Wood Alcohol From Methane

Prof. R. H. McKee and S. P. Burke discussed the interesting problem of obtaining methanol, or wood alcohol, from methane. Over 20,000,000 gal. of wood alcohol is produced each year and 10,000,000 gal. in the United States. This in itself is a rather comfortable market toward which to work. Of course it is first necessary to have cheap raw materials, and methane is cheap. It can be obtained in large quantities from natural gas in a very pure state, some gases running as high as 96 to 97 per cent methane. In addition to natural gas, methane can be manufactured cheaply also. Methane is first chlorinated and it will be worth noting that the price of chlorine is the real crux of the whole situation. The methyl chloride so obtained can be produced in fair but not quantitative yields. If now a process is worked out which will utilize the methyl chloride produced in this way without worrying too much about the quantitative transformation, the process is relatively simple. A quantitative change of methane to methyl chloride is next to impossible. The gases, then being a mixture of methane and methyl chloride, are passed with steam over lime at 375 deg. C. The gas velocity is kept down to a relatively low figure and the steam is used in large excess, since the methyl ether which is formed in some quantity from the methyl chloride is changed by means of steam to methyl alcohol. Methyl alcohol is easily condensed out and the residual gases are sent through the apparatus again.

As an alternative it is possible to pass the methyl ether formed as byproduct over aluminum oxide at about 350 deg. and change it into methyl alcohol, although the reaction takes place in steps 50 per cent at a time. It is necessary in this work to avoid iron and copper apparatus and it is also worth noting that even if the hydrochloric acid which is formed is not recovered and sold, it is possible with chlorine at 1½ cents a pound to produce methyl alcohol for 75 cents per gallon, and this allows a generous overhead of 20 cents per gallon. It is further pointed out that $1 is the necessary selling price for methyl alcohol manufactured at present if the producer is to make a profit on the product. The process looks extremely interesting, especially in view of the failing methanol supplies.

Some Objections to Filtration Formulas

Prof. W. K. Lewis pointed out the errors which are inherent in the present formulas for filtration in chamber and leaf presses when sludges which are compressible are used. In Sperry's formula, as follows, $\frac{dv}{d\theta} = \frac{P}{R} = \frac{PA^2}{rvV}$, r is assumed to be a constant for any given sludge, and this is distinctly not so with compressible sludge, because r varies with the fifth power of the voids and obviously for compressible sludges the voids diminish. Professor Lewis suggested some empirical formulas which fitted the actual plant practice fairly well, but he explained that there was no rigid theoretical basis for these formulas, yet they served a valuable purpose in the interim. Among other things which developed from this filtration study is the fact that constant rate filtration is better than constant pressure filtration. The next paper, by M. P. Woodward and W. J. Edmonds, was read by Professor Whitman of Massachusetts Institute of Technology, and discussed the experimental side of compressible sludges during filtration. Several differential equations were derived which may be regarded as fundamental for this type of work.

Paint Consistency Analyzed by the Plastometer

Another extremely interesting paper on the plastometer was read by Henry Green, who has been using it to study the property of paint consistency. This particular property is one of those indefinable things which every paint manufacturer knows and understands, but which have no lower terms or simpler terms by which they can be described. The plastometer offers a very flexible method of attacking this problem. He pointed out that viscous liquids have what is known as a telescopic flow in pipes and it is easy to photograph this telescopic flow and to distinguish it from a flocculated flow which a plastic solid would have. Paints at low temperatures show a solid flow due to flocculation and at high temperatures show a viscous flow. (This would be an additional example of Professor Bingham's differentiation of colloids into those which have a transition temperature, analogous to the melting point from plastic solid to viscous liquid.) The author added a wetting oil to a plastic mass of paint and found that the mixture became a viscous liquid. In other words,

the high wetting oil deflocculated the plastic mass. From these studies it develops that the yield value and mobility, both of which are determined in the plastometer, are dependent, first, on the viscosity of the vehicle; second, on the pigment:vehicle ratio; third, on the force of flocculation in the pigment vehicle system, and fourth, on the particle size of the pigment. The third factor is the most important and, as has been pointed out above, some methods of control and reasons for its behavior have been determined.

Corrosion of Ferrosilicon Alloys

The next paper, by Smalley, on the corrosion of iron-silicon alloys, discussed all of the iron-silicon alloys on the market in this country and in foreign countries and outlined experiments from which the optimum concentration of silicon in the alloys which would give the maximum resistance to acid corrosion could be obtained. The commercial alloys of iron and silicon are solutions of Fe_2Si in iron. The acid resistance of silicon alloys below 14 per cent silicon content is very low, but at 14 per cent it is high and remains almost constantly high until 20 per cent silicon is reached. Many faults in silicon-iron castings are due to slag inclusions and gas bubbles which are somewhat more difficult to get out than in ordinary iron castings. The most persistent concentration of silicon would be roughly 14 per cent, with some manganese present and a little carbon. The manganese in good ferrosilicon alloys, or rather, in the commercial silicon-iron, runs from as low as 0.5 per cent to as high as 2.5 per cent, and the carbon somewhere around 1 per cent or less. Rates of corrosion of various acids were studied and the corrosion of hot hydrochloric acids was found to be much the greatest. Another interesting point was the relatively low oxidation of the iron-silicon alloys at high temparatures when used in heat exchangers, etc.

A paper by Carl S. Miner, J. P. Trickey and H. J. Brownlee on furfural resins created a good deal of interest. The authors had some samples of furfural resins there and amazed some in the audience by the price which they were able to quote. Furfural has always been a very expensive chemical and the resins were therefore prohibitive in price. It is now down somewhere around 35 cents a pound, and is being produced on a commercial scale.

Prof. C. W. Foulk gave a paper on a new form of precision hydrometer, which consisted of a compensated slope and eliminated all the trouble which at the present time arises from certain tensions on the stem of the hydrometer. He has not worked out the commercial possibility of the apparatus, but present indications are that it will have a wide use. Professor Lewis then announced that the papers had been completed with the exception of one or two by title and his own paper on the decomposition of nitrates, which he did not think would be of sufficient interest to read and then deftly adjourned the meeting before anyone had time to contradict him on his own paper. *Sic semper tyrannis!*

Rubber Division

This comparatively young division treated itself to an almost ideal meeting. Our conception of an ideal meeting consists in the presentation of some new fundamental ideas and plenty of discussion of these ideas. In the paper presented by Frank G. Breyer of the New Jersey Zinc Co., data were presented which may affect our ideas on the theory of vulcanization. Mr. Breyer was describing the effect of using a new form of zinc oxide recently prepared by the New Jersey Zinc Co. on vulcanization. This oxide is by average measurement about one-fifth the size of the present marketed product. There is a very large percentage of oxide which is considerably smaller than this average. The effect of this new oxide is distinctly different from that of the normal oxide. This may be due to the average smaller size and it may possibly be due to the percentage of very fine material. The effect seems to be much greater than five times, which is the ratio of size. In compounding rubber with this zinc oxide on the rolls, very much more energy is required to push the oxide into the rubber mix and considerably more heat is therefore developed. Once the mix is compounded thoroughly, the vulcanization or curing is carried out in 30 to 40 minutes as against 150 minutes with ordinary zinc oxide. The tensile strength of this compound is 3,500 as against 2,800. The striking thing about this mix is that when an accelerator is compounded with it in addition to the zinc oxide and sulphur, the curing time is not diminished at all and the tensile strength is increased to 3,800. This is exactly the reverse of our present ideas, for zinc oxide was thought to have only a good reinforcing effect on vulcanized rubber and this new oxide is shown to have an accelerating effect as well. Furthermore, organic accelerators are shown to give additional reinforcing effect with this new zinc oxide.

In addition, this zinc oxide is neutral to phenolphthalein and it is assumed that phenolphthalein neutrality has something to do with the success of this zinc oxide, for when the oxide is sprayed with sulphur dioxide the curing time rises to 4 hours. In other words, it seems that acidic impurities completely nullify any effect which either the size or the neutrality may have had on the vulcanization time. Mr. Breyer advanced a theory to explain this which is not very different from that originally advanced by Ostwald to explain rubber vulcanization, suggestion that it is a physical rather than a chemical phenomenon. This theory was abandoned when the use of accelerators became common, and an elaborate theory of the action of the accelerator has been developed.

Mr. Breyer claims that it is only necessary to state that the zinc oxide has a definite absorptive affinity for sulphur, which affinity is poisoned to some extent by the introduction of acidic impurities. The greater surface of this new zinc oxide and its neutrality both would fit in well with this theory of explaining the acceleration of the curing time.

The Hysteresis of Rubber

Another excellent paper was presented by W. W. Vogt of Goodyear on the hysteresis of rubber. Details of a machine for determining hysteresis loss in various rubber compounds was described. The machine was ingenious and variations were measured by a pendulum throw transmitted from a rotating shaft by means of the rubber compound to be tested. Data were given showing hysteresis loss in rubber when developing 40 to 400 cycles per minute. This is substantially the condition which develops in the field when an automobile is going from 4 to 40 miles per hour. The results are very informing on the physical properties of rubber in tires. It is interesting to note in passing that carbon black shows less hysteresis loss than zinc oxide, which is in turn less than clays.

Bedford and Gray developed a theory for the action of dithiocarbamates and thiurandisulphides which is substantially the formation of zinc salts destroyed in vulcanization. Evidence for this is that excess ZnO aids the activity of these accelerators. D. F. Cranor discussed the temperature developed by certain tread pigments, confirming scientifically some popular knowledge on this subject.

Tearing Test Developed by E. C. Zimmerman

An excellent paper by E. C. Zimmerman on tearing tests described an ingenious and accurate method of estimating the rate of tearing. Another point on vulcanization not known before was brought out by Ira Williams and D. J. Beaver when they asserted that the temperatures developed in vulcanization were much higher than the temperature applied. In other words, the reaction is exothermic. These results were obtained by molding rubber mixtures around steam pipes and inserting thermocouples in the mass. The actual number of degrees rise is not significant, depending on the thickness of layer, radiation, air currents, etc. In an electric apparatus temperatures 40 deg. above the temperature of the heating unit were recorded.

Dr. E. B. Spear called attention to the fact that in using thermocouples the radiation factor must not be neglected, and in another paper with H. A. Endres discussed the limitations which had been discovered to the obscuring power test developed in the Goodyear laboratories.

A number of other interesting papers were read on effect of ingredients in vulcanized rubber, and some excellent pictures were shown on the crystallization of sulphur by H. A. Endres. Reports of committees were heard and progress was recorded.

Division of Dye Chemistry

The most interesting papers read before the Dye Division were two that the authors apologized for as being scarcely technical enough to be presented to dye chemists. As a matter of fact, J. Merritt Matthews aroused the admiration and amazement of the meeting by his collection of batiks and Oriental dyed fabrics and his description of the tedious but effective methods used for their production. Art dyeing is done practically altogether by hand methods and the color is built up on the fabric in accordance with the imagination of the artist. This, therefore, implies that the methods of dyeing must be handled in an understanding way by a craftsman or artist who must be something more than a mere artisan. The principal forms of dyeing employed in art work are the batik style, tied-and-dyed work, stenciling, block printing, spray dyeing and shaded dyeings. The second paper referred to was A. F. Shupp's talk on the laundering of textiles. Mr. Shupp described some of the work at Mellon Institute in connection with the fellowship maintained by the American Laundry Owners' Association, and it was a valuable lesson in the practical importance of the proper application of the right dyes for special purposes. Frequently, it seems, the first trip to the laundry changes a gorgeous "silk" shirt into a ludicrous bundle of rags resembling a battle-scarred flag preserved from the Crimean war and a hotel towel with the inevitable red stripe into a raveled rag with a few discouraged threads replacing the crimson band and making a last feeble effort to hold the two halves together. Popular belief and joke books to the contrary notwithstanding, these unfortunate occurrences are more often due to the improper application of dyes and finishing of the fabric than to maltreatment by the laundryman. The work at Mellon Institute protects the laundry owner from the wrath of his customers by scientifically establishing this fact in many cases where the inferior quality of the goods is responsible for its destruction.

Symposium on Methods for Standardizing and Testing Dyes

From the point of view of the dye chemist, the most important discussion before the division was aroused by the symposium on methods for standardizing and testing dyes. Robert E. Rose, of E. I. du Pont de Nemours & Co., arranged the symposium and led the discussion. Walter M. Scott, of Cheney Bros., South Manchester, Conn., presented a general discussion of various methods for estimating the strength of dyestuffs, including colorimetric comparison, the titanium chloride titration method, the Kjeldahl nitrogen determination method and the estimation of the inorganic salts which have been used in the standardization of the dyestuff. The application of these methods to typical acid, basic and direct colors was shown by tables giving the result of the analyses of several samples of each type. Edward H. Gamble and Robert E. Rose presented a discussion of the titanium chloride titration, pointing out the shortcomings of the method. W. C. Holmes described a method for the direct evaluation of dye in a sample of erythrosine based on the gravimetric determination of the color acid. The excellent results obtained have initiated further work to determine the applicability of the methods to other dyes of the eosine group and to afford evidence regarding their constitution. In the absence of interfering substances, the consumption of acid involved in the precipitation of the color acid is determined by the dye and soda ash present and may be utilized as a convenient means of estimating the latter.

A committee was appointed on methods of standardizing and testing dyes consisting of R. E. Rose, chairman, L. A. Olney, J. M. Matthews, W. M. Scott and J. A. Ambler. This committee will co-operate with the Association of Textile Chemists in this work.

Other Papers

Among the other papers of interest were three contributions from the Color Laboratory, Washington, D. C., by C. E. Senseman and O. A. Nelson, which were read by J. A. Ambler. The papers presented a mathematical treatment of some of the properties of the coal-tar hydrocarbons and intermediates. Truth be told, the majority of the audience was somewhat dizzy after watching Dr. Ambler juggle the Clapeyron equation in calculating the vapor pressures, latent heats and entropy of vaporization of naphthalene, anthracene, phenanthrene and anthraquinone. M. L. Crossley, of the Calco Chemical Co., spoke on the relation of color, constitution and chemical activity of dyes. There was nothing particularly new or startling in anything Dr. Crossley had to say, but it was an interesting survey of the subject and was well delivered by the aid of some beautiful sample charts of dyed fabrics.

Officers of the division for the coming year were elected as follows: Chairman, W. J. Hale; vice-chairman, R. E. Rose; secretary, R. N. Shreve.

Natural Dyestuff Industry and Reserves of Latin America

The Romance of the Natural Dye Industry and Its Struggle for Existence Against the Rise of Synthetic Dyes—Importance of Natural Dyes in Case of War or Other National Emergency

By Otto Wilson

EXCEPT as a reserve Latin America has long since passed its peak of importance as a source of dyeing materials. Its decline has, of course, been due to the same factor that has laid low the indigo industry in India and most others having to do with natural dyestuffs throughout the world—the irresistible advance of the synthetic dyes. The tropical forests of the Caribbean regions are still called upon for certain of their famous woods every year, but the business of gathering and working up most of these materials is in large part an industry of the past. Only a very few have been able to withstand the pressure of the synthetic products and maintain a rather precarious foothold in the world's commerce.

The true rôle of these natural dyestuffs is that which they played in the late war. They form a most convenient reserve on which our dye-using industries may fall back when for any reason the usual flow of the synthetic dyes is cut off. With an American dye industry we are not likely again to be left high and dry as we were in 1914, at least not in the near future.

Importance of a Reserve Supply

Yet that is not an impossibility. It would seem the height of absurdity to suggest that after the pinching times of 1914 to 1916, when, as one writer has said, a man could have sold a section of the rainbow to American dye users if he could have guaranteed delivery, we should calmly permit ourselves to drift back into the same dependence on a transoceanic source of supply for coloring materials as before the war.

When in addition it is noted that through the vastly increased use of explosives and the introduction of gas warfare on a large scale, the chemical industry has become practically the basis of modern warfare, it would seem obvious that national prudence would imperatively dictate the preservation of the dyestuff-manufacturing business. Yet one of the striking features of the after-the-war period is the rapidity with which the hard-learned lessons of the war are forgotten. The protecting embargo against foreign dyes was strenuously resisted in Congress when it was first proposed, and the Senate has recently refused to renew it for another year. It is not impossible that this lesson in chemistry may also fade out of our national memory and the manufacture of our dyes slip back again to German factories. So it is just as well that we keep an eye on our natural reserves. If an emergency again arises—and the day of emergencies is not over—we may again have to turn to our southern neighbors for supplies of colors until we can get our factories to work.

The Romance of Natural Dyes

If the chief future rôle of Latin-American dyewoods is to be that of a reserve, it has not been so many years since they occupied a much prouder place in the colors industry. They have been known to the white race almost as long as the New World itself, and for the better part of four centuries they played a prominent part in the stirring drama of transatlantic commerce. They were among the first of the exports by the early explorers, and in fact their abundance and quality gave a great new impulse to the whole art of dyeing in Europe. When the Spaniards saw the abundance of redwood trees in the tropical Amazon forests, they called the new country Brazil, from *braza*, or fiery red. When the marauding British buccaneers, between raids on the Spanish galleons, settled on the coast of the Spanish territory in Central America to cut logwood in defiance of the King of Spain, they gained for England what is now the colony of British Honduras. The trade was never really interrupted and before the late war Caribbean dyewoods were going to England, Holland, Germany, France and even Russia, although of course in smaller quantities than in former times. The war stimulated production and raised prices immensely, bringing a general revival in several lines of the industry. But when the factories of England, France, Italy and the United States reached full production, the

GENERAL VIEW OF LOGWOOD DEPOTS OF CAPE HAITIEN

A PATH THROUGH THE WOODS IN DUTCH GUIANA

demand dropped off and the difficulty in getting ships further checked the boom. The synthetic dyes are now in the field again in full force and the ax of the tropical woodsman is busying itself more and more with other kinds of trees than those which yield the colored woods.

Logwood

Of all the Latin-American dyestuffs, the one which has put up the most determined resistance to the conquering aniline dyes is the pioneer and leader of them all, the famous logwood. In the early years of the Spanish conquest the exporting of this wood began and its exploitation has continued from that day to this. Until the coming of the synthetic dyes it was one of the leading world sources for coloring materials, and in 1914 it was still holding an important place in the dyeing industry, although losing ground gradually to the artificial dyes. With the shutting off of the German supplies, logwood came into immediate strong demand; exports increased several hundred per cent and prices went skyward. The figures (Table I) of imports of logwood into this country show how greatly the trade increased and how it has dropped off again as our domestic dye industry has developed.

TABLE I—IMPORTS OF LOGWOOD INTO THE UNITED STATES

	Tons	Value
1912	40,030	$511,556
1913	38,277	469,430
1914	40,862	522,434
1915	60,958	832,196
1916	186,816	6,097,576
1917	61,735	1,519,878
1918	29,841	668,141
1919	29,022	549,885
1920	72,830	2,186,860
1921	26,740	636,932

The particular qualities of logwood which have enabled it to keep a place in the dyeing industry against intense competition are thus described by the United States Tariff Commission:[1]

> Logwood is the most useful dyestuff for the dyeing of blacks. It is used for blacks on silk, wool, leather, cotton, fur and straw and in the preparation of inks and color lakes for wall-paper printing. It finds considerable application also as a darkening constituent in grays, tans, browns and compound shades, and has a small use for production of blues. Salts of chromium, copper and iron serve as mordants in logwood blacks. Previous to the introduction of coal-tar dyes, logwood was used in the production of a variety of blues and purples. At present logwood is used almost exclusively in the production of blacks and as a darkening constituent in compound shades.
>
> On animal fibers the underhand solid blueness and overbloom which logwood blacks retain in artificial light have made it the standard black. The synthetic dyes have not been able to duplicate these qualities fully. On wool it offers keen competition to the coal-tar colors. On silk it is the most important black. Silks will absorb over 200 per cent of extract, thus serving as a weighting agent. A properly dyed black on silk increases the durability and resistance to wear and tear. On cotton, logwood blacks are of poor fastness and are used only for cheap blacks in dyeing and calico printing. The sulphur blacks, "aniline black" and certain "developed blacks" have displaced it for fast shades.
>
> Up to the period of the great war the coal-tar dyes were gradually displacing logwood, due to their lower labor cost in application. In addition certain coal-tar dyes had greater fastness for special uses. The extract manufacturers are meeting this labor cost competition by new extracts which dye and mordant in one operation. Logwood, in common with the other natural dyes, was subjected to the most unscrupulous competition by the German dye firms. It apparently was their intention to annihilate the natural-dye industry.

Logwood, *Hæmatoxylon campechianum linn.*, or, as it is sometimes called in the countries where it is grown, "campeche wood," is a distinctly American product. Travelers in the forests of any section of tropical America, in Mexico, Central America, northern South America and the Caribbean Islands may occasionally come across the low trees, but the favorite growing grounds are in a belt which begins with British Honduras on the mainland and extends eastward over the islands of Cuba, Jamaica and Haiti. The British Honduras wood is said to be the best in quality, but the cost of getting it out, especially as the supplies near the river banks are cut away, have caused the traders in forest products to turn their attention more and more to mahogany and chicle.

The United States gets its supply largely from Haiti and Jamaica. In the former country logwood cutting is still one of the leading activities. One factory formerly worked up about 5,000 tons of wood each year, but it has recently burned and only the logs are now exported. Logwood grows in most parts of the island of Haiti, which includes both the country of that name and the Dominican Republic. In both countries it has been cut away near the seacoast, but great quantities are said to exist, practically untouched, in the interior, and these will become available as highways are built and transportation is made cheaper. Jamaica works up very con-

Photo by J. H. Hare, Collier's Weekly.

LOGWOOD DEPOT IN HAITI

[1] "Tanning Materials and Natural Dyes," Tariff Information Surveys, paragraphs 30 and 31 of the tariff act of 1913. (Published in 1921.)

siderable quantities of extract, using about 45,000 tons of wood a year in her two factories, and logwood extract forms an important item in the trade of the island. In the year before the war clouds broke in Europe Jamaica sent $850,000 worth of the extract to foreign countries, mostly to England and Holland, but also to Belgium, Italy, Germany, France and the United States. We took only about $10,000 worth, as our interest lay in the logwood itself. In 1913 we bought 17,000 tons, having a value of $530,000, out of the total Jamaican exports of 50,000 tons. It is said that the Jamaican industry could be developed so as to meet the full demands of the American dye users for the extract if it should be admitted free of duty.

Manufacture of Logwood Extract

The manufacture of logwood extract is carried on in a number of countries. For the most part these countries make the extract from imported logwood for their own use, but there has been some competition in international trade. England, France and the United States are probably the largest producers. In this country logwood extract has been a factory product almost as long as the country itself has existed, some plants having operated continuously since 1794. In 1914, according to the census figures for that year, nine plants produced 29,000,000 lb. of extract, valued at $1,312,000, a considerable falling off as compared with production at the beginning of the century. There are now eight large producers and several smaller plants. All the factories are on or near the Atlantic seaboard, conveniently close to the source of raw materials.

WEIGHING LOGWOOD, PORT-AU-PRINCE, HAITI

A LOGWOOD FOREST NEAR PIQUORE, HAITI

In manufacturing, the wood is first rasped or chipped into fine pieces or a coarse powder. Formerly this was simply piled in heaps, moistened and allowed to ferment or "cure," but this oxidizing process is now largely carried on in mechanical extractors. The coloring principle, hæmatoxylon ($C_{16}H_{14}O_6$), exists in the wood partly as a glucoside and partly free, and has to be oxidized to form the actual dyestuff,[2] which is hæmatein ($C_{16}H_{12}O_6$).

The uncured chips are placed in an extractor, water is added, and extraction is carried on under pressure. The thin liquid resulting is permitted to settle to remove resinous substances and is then evaporated to a consistency of 51 deg. Tw. It goes into commerce in this semi-liquid form and is also further concentrated to a solid form. By treating the extract with oxidizing agents, a substance called hæmatin extract is formed, which when evaporated forms hæmatin crystals. Logwood extract with iron or chromium mordants yields a black dye and with alumina or tin violet blues and grays.[3]

Fustic

Second only to logwood as a natural dyestuff is fustic, or old fustic, as it is sometimes called to distinguish it from young fustic, an entirely different wood. Botanically it is known as *Chlorophora tinctoria* (Gaudich), or *Morus* or *Maclura tinctoria*, and in the countries where it is grown it goes by the name of Cuba wood, yellow wood, palo amarillo or fustic. It is closely related to the osage orange that grows in this country. In fact the latter was substituted for it during the war when shipping conditions prevented importation from the West Indies.

Fustic wood is the source of a yellow dyestuff used as a distinct dye and also with other dyes for obtaining compound shades. With aluminum and tin it yields a bright yellow color and with iron and copper various olive shades. In general these colors are only indifferently fast to light, but with chromium as a mordant olive-yellow and old-gold colors are obtained which are said to be fast to both light and milling. Fustic colors were formerly widely used for dyeing wool, and they are still of much importance, although they are being more and more displaced by the coal-tar colors, which are said to be cheaper to apply and more fast. In wool dyeing, the chief mordant used is potassium bichromate and it is usually employed, on both wool and silk, in combination with other dyes to produce various shades of olive, brown, drab, etc., and in the shading of blacks. In cotton dyeing, fustic has had extensive use in coloring khaki cloth for tents and uniforms.

The "old fustic" tree is a native of the same tropical forests of America as logwood and its occurrence is about as widespread. Brazil, Colombia and Venezuela in South America; Honduras, Costa Rica and Panama in Central America; the lowlands of Mexico and the islands of Cuba, Jamaica and Haiti, all claim the fustic tree as a native product. The best wood comes from the Tampico district in Mexico and from Cuba, that from Brazil and Jamaica being regarded as of lower

[2] Thorpe, "Outlines of Industrial Chemistry."

[3] Heermann, Paul, "Dyers' Materials." London: Scott, Greenwood & Son. 1919.

FUSTIC LOGS READY FOR SHIPMENT

quality. The trees grow 60 or 70 ft. high and the wood is very heavy. Only the heartwood is used for dye-extracting purposes. A feature that materially increases the cost of bringing the wood to the market is that the trees are scattered thinly through the forests and are not found in groves like logwood.

Fustic wood has two coloring principles,[4] morin ($C_{15}H_{10}O_7 2H_2O$) and maclurin ($C_{13}H_{10}O_5$), with quite distinct properties. In preparing the extract for dyeing, the wood is chipped and an extract obtained in the same way as from logwood. To separate the morin from the maclurin the extract is treated with a little acetic acid and then with lead acetate solution, causing the morin to precipitate as a yellow lead compound and leaving the maclurin in solution. By further treatment of this precipitate crystals of crude morin are obtained while crystals of maclurin are separated from the original solution. Both crystals are in the form of colorless, or almost colorless, needles. Maclurin is rather more soluble in water than morin.

Young fustic, *Rhus cotinus linn.*, is a native of Europe and the West Indies, and was used in Europe before old fustic was known. It also yields a yellow coloring matter, called fisetin ($C_{15}H_{10}O_6$). Young fustic is little used today, as its colors are not fast.

Annatto

A dyestuff which is now little used in coloring fabrics, but which is of considerable value for coloring butter, margarine, oils and cheese, is annatto, or "arnotto." It gives an orange-red color which is very fugitive to light, but which resists soap and acids very well. When it is used at all for dyeing cotton, it is dissolved in a boiling solution of carbonate of soda, while for silk the same chemical is used half and half with annatto. When used with alumina as a mordant, annatto forms an orange lake and with tin a lemon-yellow lake. In acid solutions it yields a red color. It is partly soluble in water and more soluble in alcohol and alkaline solutions.

Like logwood and fustic, annatto grows in the islands of the Caribbean and in the lands that border that sea on the south and west, as well as in northern Brazil. Its use antedates even that of logwood, as the natives who greeted Columbus and the later adventurers from Spain used it to paint their faces and bodies. It is cultivated in many parts of the West Indies and in the Guianas and other parts of South America. In the country around Port Limon, the Caribbean port of Costa Rica, annatto plants are said to grow abundantly and there is an opportunity to cultivate them for commercial purposes. Our supply comes in large measure from Jamaica, where continued cultivation has made it an item of some importance in the export trade.

The annatto plant, *Bixa orellana linn.*, is a small tree or shrub growing 8 to 12 ft. high. The coloring matter comes from a reddish waxy pulp which covers the seeds. Full crops are not gathered until 3 or 4 years after the seedling plants have been set out, the yield then being about 500 or 600 lb. of seed per acre, the amount increasing for several years. In Jamaica the growing of the annatto and the gathering of the seeds is almost wholly carried on by the peasant class, the women and children for the most part attending to the gathering and drying of the seeds when the miter-shaped capsules in which they are contained split open. The waxy "testa" of the seeds is removed by stirring the seeds in boiling water, and after some days it is passed through a sieve. The liquid is permitted to stand for a week or so to ferment, the dye material meanwhile settling to the bottom. The clear water is decanted off and the residue is evaporated to a putty-like consistency and shipped in rolls or casks, reaching the market as a thick paste or in dry cakes. It is possible to remove the pulp from the seeds and prepare a dyestuff for market without fermentation. The best annatto comes from the Guianas and contains 10 to 12 per cent of the pure dye.

The chief coloring matter of annatto is called bixin. It can be crystallized from a chloroform solvent into brown-red or deep-red rhombic crystals. In this form it is fairly soluble in chloroform or alcohol and less soluble in other common solvents. It dissolves in concentrated sulphuric acid to form a cornflower-blue liquid. The formula for bixin is in dispute,[5] different authorities giving it as $C_{25}H_{34}O_5$, $C_{27}H_{34}O_5$, $C_{27}H_{32}O_4$ and $C_{26}H_{30}O_4$.

Brazilwood

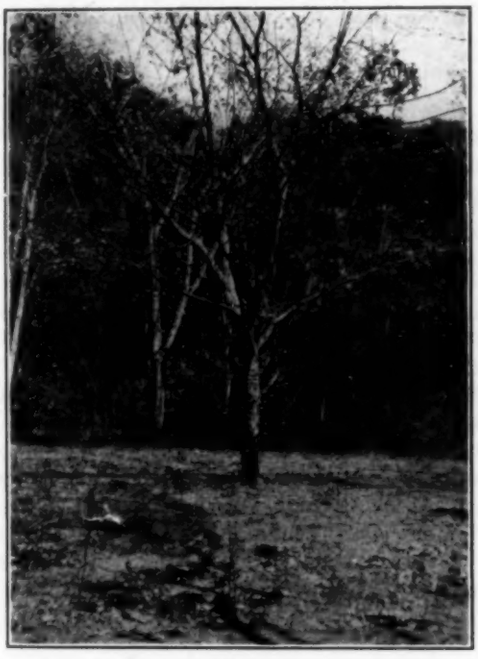
Most noted of all the Brazilian dyestuffs is the famous brazilwood, which has been known practically since the discovery of the country, but which is now of little commercial importance. This is one of a number of redwoods, of which there are two classes—soluble and insoluble. The Latin-American redwoods come under the former classification and are species of the genus *Cæsalpinia*, the four most important in America being brazilwood, Pernambuco wood, peachwood and limawood, although the term brazilwood is sometimes applied to all the woods of this class. The true brazilwood, *Cæsalpinia brasiliensis*, is very plentiful in the forests of the north. It is brick-red inside and brown-red on the surface, and is very hard. It is found only in Brazil, although the other species of *Cæsalpinia*, especially limawood, occur throughout the forests of Central America and other tropical regions.

Brazilwood extract is called "hypernic" and is obtained in much the same manner as logwood extract. It is sold as a 51 deg. Tw. extract and as a solid. Its coloring principle is brazilin ($C_{16}H_{14}O_5$), which crystal-

[4] Perkin, A. G., and Everest, A. E., "The Natural Organic Colouring Matters." London and New York: Longmans, Green & Co., 1918.

[5] Perkin and Everest, "The Natural Organic Coloring Matters."

lizes either as colorless needles containing $1\frac{1}{2}$ H_2O or as colorless prisms with $1H_2O$, and is readily soluble in alcohol and water, as well as in a dilute solution of sodium carbonate, in which it gives a beautiful carmine-red color. Brazilin is changed by oxidation to the actual coloring matter called brazilein, a reaction which takes place readily on exposure to the air. Brazilein forms dark needles of a gray metallic luster, freely soluble in hot and slightly soluble in cold water. With aluminum salts it forms a red color lake. On wool it yields brown or reddish-brown shades with bichromate, blue shades with sulphate of alumina and scarlet with stannic chloride. The colors yielded by brazilwood extract are fugitive and its principal present use for textiles is as a reddening constituent to modify shades



A FUSTIC TREE

of other natural dyes. When used alone, its chief employment is for dyeing leathers dark red and red-chocolate.

Of the other redwoods mentioned, Pernambuco wood, *Cæsalpinia ciesta*, is the richest in coloring matter, containing about twice as much as brazilwood. It is abundant in Jamaica and Brazil. Peachwood, *Cæsalpinia echinata*, is found in Mexico and Central America.

INDIGO

The America species of the indigo plant, *Indigofera anil linn.*, is widespread throughout Latin America, from Brazil to Mexico, but it has been little cultivated in recent years. Before the discovery of synthetic indigo the cultivation of the plant had reached important proportions in some countries. Venezuela records an exportation of 1,800,000 lb., worth $2,250,000, as far back as 1802, but the growing coffee industry attracted the attention of planters and indigo cultivation was gradually abandoned. Today the plant grows everywhere as a weed and is little utilized.

The only country in which the indigo plant has furnished important supplies for export in recent years is Salvador, where cultivation on a considerable scale has been maintained for a long while. In 1910 that country sent to Europe and the United States $314,000 worth of indigo, but the trade dropped to $55,000 in 1913. There was an increase in the next year to $98,000, of which England took the largest share, $32,000, the United States following with $20,000. Then came the war and the industry boomed, exports going as high as $600,000. Since the war production has fallen back. Colombia also sent us a few thousand dollars' worth during the war, but exports stopped when our factories became fully active. Costa Rica sent a small amount in 1919, and there is said to be some manufactured in Guatemala. Mexico in 1918 exported considerable quantities to Spain and Japan.

COCHINEAL

A natural dyestuff for which the world is indebted to Mexico is cochineal, the once important red color obtained from the insect *Coccus cacti*. This has been used for centuries in its native country, and from there it was early taken to the Canary Islands, Java and other parts of the Old World. It is the only important dye derived from animal life. The insects feed on a particular variety of cactus which grows wild naturally but is cultivated for the sake of its tiny guests. Only the female insects are used for making dyes, as they do not have wings and remain on one part of the plant. They are brushed off before the beginning of the rainy season and are killed either by being placed in an oven or by the use of hot water or steam. When the former process is used, a silvery down is preserved on the body of the insect and the resulting color is known as "silver gray" or "silver cochineal." When hot water or steam is used, the resulting color is dark, red or brown, and a product known as "black cochineal" results. No other preparation besides grinding is necessary before the cochineal is used as a dye.

Cochineal dyes were formerly in wide demand, but like most other natural coloring matters, they have practically yielded the field to the coal-tar products. They were little used for cottons, but were extensively employed on silks and woolens. On wool they give a fiery scarlet when mordanted with stannous chloride, oxalic acid being added to the bath, or with special preparations of stannic chloride. Wool mordanted with aluminum sulphate and tartar and then dyed in a separate bath with cochineal takes on a crimson color, and with ferrous sulphate and tartar, purplish, slate or lilac colors are produced. In dyeing silk crimson, alum or tin mordants may be used, with cream of tartar and oxalic acid. The artificial azo-scarlet dyes are now largely used in place of cochineal on textiles. To a limited extent cochineal is used as a coloring matter for foodstuffs, candies and face powders.

MISCELLANEOUS COLORS

Other dyestuffs of the Latin-American countries which have been or might be used are numerous, but there is small prospect that they will become of importance to foreign interests. The forests of Brazil[6] contain a considerable variety of dyewoods and other color-producing plants, practically all of which are now of either historical or purely local interest. In foreign markets they have little chance, but there is a limited

[6] At a cotton congress held in Rio de Janeiro in 1916 Dr. Miguel Calmon, chemical director of the Companhia Industrial do Brasil, gave an address on the use of native vegetable dyes. This address does not seem to be available in the United States, but those wishing to follow up the subject can probably obtain full information by addressing an inquiry to Dr. Calmon in care of the above company.

field for them in Brazil. That country has an important cotton-growing and cotton-manufacturing industry, both of which are receiving much encouragement from the government, and as the output of cotton cloth increases, more and more interest will naturally be taken in developing the native dyestuffs. There are already dye factories in Minas and Cubatão, and the chemists of the country are fully alive to the possibilities of its resources in color materials. In current books on Brazil mention is made of dyes from "inglotina," made from mangrove leaves; two anils, *Cissus tinctarea* and *Cissus sicyoides*, which are said to give fine blue colors; indigo; some fuchsias which give a black; and other trees which yield a brilliant yellow. Annatto grows in most parts of the country.

In Venezuela, besides fustic, brazilwood, annatto and indigo, there are several plants known locally for their coloring properties. A tree called "amarillo," *Aspidosperma vargasii*, belonging to the family of the dogbanes, has a bark which gives a yellow dye and some tannin. The bark of the onotillo tree, *Vismia ferruginea*, of the St. John's wort family, also gives a reddish-yellow, resinous substance, which can be used like gamboge. Two others yield a yellow or yellowish-red dye. They are known as "rasura de cucharo," *Condaminea tinctorea*, and "bosna" bark, *Zanthoxylum ochroxylum*, the latter containing berberidine. Red mangrove bark, *Rhizophora mangle*, yields a red pigment which can be used for coloring leather.

Mexico has a wide variety of color-bearing plants. One said to be highly regarded by dyers is *Reseda luteola*, which gives a yellow coloring principle "luteolina" ($C_{15}H_{10}O_6.2H_2O$). Other plants yielding yellow dyes are yellow or Cuba wood, malacate, curcuma or camotillo and several varieties of azafran and azafrancillo. Among those which give blue coloring materials, besides indigo and related plants, is one known locally as "muitle." A number of others yield red dyes and from a few are obtained materials for coloring fabrics green and black.[1]

Washington, D. C.

Legal Notes

By Wellington Gustin

Buyer, Committing First Breach of Contract, Cannot Sue for Seller's Subsequent Breach

In the case of Dawson Cotton Oil Co. versus Jones, the company sued E. & F. G. Jones for damages for a breach of contract for failure to deliver about 57 tons of product of 100 tons contracted for. Defendant pleaded that the company before the time fixed in the contract for final delivery, being fearful that the market price would decline, called upon it to make immediate delivery of the remaining 57 tons or give a further guarantee that the product would be delivered; then, it alleged, the company by its agent refused to accept a carload then being loaded and gave notice that it would accept no more under the contract.

In short, the defendants contended that the company first breached the contract by refusing to accept a carload and notifying them that it would accept no more of the product, all before the expiration of the time stated in the contract for delivery. This plea the Supreme Court of Florida has held to be a valid defense to an action on the contract for breach for failure to deliver according to its terms. The seller averred that the buyer committed the first breach by refusing to accept, which, if true, the Supreme Court holds to be a good defense, reversing the trial court's judgment.

This contract was in the form of a letter by the Dawson Cotton Oil Co. to E. & F. G. Jones, signed by an official of the company and accepted by E. & F. G. Jones. Among other things it provided for delivery in October, November or December following, at option of the seller; shipment made with buyer's privilege of inspection; and should there be any dissatisfaction as to the grading of the peanuts, it should be "left to the regular rules of arbitration, and the party whom it shall be decided against shall pay all costs."

Measure of Damages for Failure to Deliver Under Contract

In an action brought by H. P. Pearl & Co. against the Packard Iron & Metal Co., plaintiff sought to recover damages for a breach of contract for the non-delivery of a carload of iron. A judgment was rendered on trial for plaintiff, and defendant appealed to the Court of Appeals of Maryland, where the judgment was affirmed. (115 Atlantic, 761.)

The Court of Appeals held that in an action for damages for non-delivery of the iron, evidence as to its market value during the month wherein delivery should have been made was admissible, in view of the uniform sales act, providing that where there is an available market the measure of damages is the difference between the contract price and the market price at the time when the goods should have been delivered.

Provisions of Uniform Sales Act

Damages for failure to deliver goods as provided in uniform sales act, are set out as follows:

"(1) Where the property in the goods has not passed to the buyer and the seller wrongfully neglects or refuses to deliver the goods, the buyer may maintain an action against the seller for damages for non-delivery.

"(2) The measure of damages is the loss directly and naturally resulting, in the ordinary course of events, from the seller's breach of contract.

"(3) Where there is available market for the goods in question, the measure of damages, in the absence of special circumstances showing proximate damages of a greater amount, is the difference between the contract price and the market value or current price of the goods at the time or times when they ought to have been delivered; or, if no time was fixed, then at the time of the refusal to deliver."

Opinion on Similar Point in Another Case

On a similar point in an Illinois case, Summers vs. Hibbard, 46 Am. St. Rep., 872, the court says:

"There is no doubt of the correctness of the rule stated by appellants that, where delivery is required to be made by installments, the measure of damages will be estimated by the value at the time each delivery should be made."

[1] A full account of several dye-plants of Mexico will be found in a pamphlet (in Spanish) of thirty-eight pages entitled "Las Plantas Mexicanas y Algunas Exoticas Productoras Colorantes," by Juan Manuel Noriega, issued by the Government of Mexico in 1919.

Electrical Characteristics of Dry Cells—II*

By G. W. Vinal and L. M. Ritchie

Explaining the Behavior of a Dry Cell in a Circuit and the Effect of Internal Resistance, With Equations and Curves—Grouping of Cells Is Also Discussed and Diagrams Are Drawn

In PART I of this paper, on the characteristics and testing of dry cells,[1] are given a discussion, tables of data, and curves showing the effect of temperature on the voltage, short-circuit current and service capacity. With a rise in temperature the coefficient for the voltage, current, deterioration of cells on the shelf and at low current drains becomes positive. Capacity of the cells, which is usually measured as days or hours of service, is also expressed in terms of ampere-hours and watt-hours. The measurements are made by constant resistances on continuous and intermittent discharges and by constant current on continuous discharge. Curves of the most reliable data are shown which will permit the calculation of the capacity at different rates of discharge to a number of end points. Examples are given showing the method of reading the curves and computing the results.

This second article deals with the theory of dry cell behavior in an electrical circuit, including the effect of grouping, internal resistance of the cells, and other circuit characteristics.

Behavior in a Circuit

By the open-circuit voltage of a dry cell is meant the electromotive force of the cell when it is not producing any current. Such a measurement can be made on a potentiometer. If a resistance is connected across the terminals of a cell, a current will flow through the circuit from higher to lower potentials—that is, it flows from the carbon to the zinc. The current, however, does not begin with the carbon and end with the zinc, but flows through the cell also. It is evident, then, that within the cell the current flows from the electrode of lower potential to the electrode of higher potential, being made to do so at the expense of the chemical energy of the cell.

If a potentiometer be used to measure the potential difference at the terminals of a cell when it is discharging through an external circuit, it is found that the voltage measured is less than for the cell on open circuit. Designating the open-circuit voltage of the cell by E and the potential difference at the terminals of the cell by E' when a current I is flowing through an external resistance R it is found that:

$$E' = IR \qquad (1)$$

That is, Ohm's law is here applied to the portion of the circuit which is external to the cell. The difference $E - E'$, therefore, represents the voltage drop in the cell itself. Since the current is the same in the cell as in the external circuit Ohm's law shows that:

$$E - E' = Ib \qquad (2)$$

where b is a quantity that represents the internal resistance of the cell.

Adding equations 1 and 2 the general expression for Ohm's law as applied to the entire circuit becomes

$$E = IR + Ib$$

or

$$I = \frac{E}{R + b} \qquad (3)$$

The total resistance of the circuit is the sum of the external resistance of the circuit and the internal resistance of the cell. For the ordinary dry cell, when fresh, b is a small quantity and may usually be neglected in comparison with R, but as the cell is used up b increases and I decreases. When the cell is no longer able to perform its service, it will be found that while E has decreased somewhat, b has increased to many times its initial value.

The maximum current which a cell can deliver is, by equation 3, putting $R = 0$:

$$I = \frac{E}{b} \qquad (4)$$

In making measurements, R cannot be made exactly zero, since the shunt and lead wires of the ammeter must necessarily have some resistance. This resistance, however, can be made very small. In standard practice it is 0.01 ohm. When $R = 0$, or nearly so, the value of I is called the short-circuit current of the cell.

Electrical power is the rate of expenditure of electrical energy and is measured in watts. The watt is the power when a current of 1 amp. flows through a resistance of 1 ohm. Consequently the number of volts multiplied by the number of amperes equals the number of watts; or, in general

$$IE = P$$

The power derived from the cell at any time is, therefore, the product of its electromotive force E by the current which flows, I. Part of the energy is expended in the cell itself and part in the outside circuit. Since the current is the same throughout the circuit the expressions for the power expended in the battery and outside of it are obtained by multiplying I by the fall in potential in each part of the circuit. Inside the cell, this is

$$(E - E')I = P_1 \qquad (5)$$

Outside the cell, it is

$$E'I = P_2 \qquad (6)$$

Referring to equations 1 and 2, the values for $(E - E')$ and E' in terms of current and resistance are obtained. Substituting these in equations 5 and 6 and at the same time adding these equations

$$P = P_1 + P_2 = I^2b + I^2R \qquad (7)$$

Assuming that $R = 0$ or is nearly so, I^2R also equals zero, leaving the equation for the power expended

$$P = I^2b$$

This means that when the cell is delivering its maximum current (equation 4), all the power is expended in the cell itself and is dissipated in the form of heat. Although 25 amp. or more may thus be drawn from the cell, the current does no good except to indicate the condition of the cell. On the other hand, equation

*This paper is taken from Chap. IV of the forthcoming circular 79 of the Bureau of Standards on Electrical Characteristics and Testing of Dry Cells. Published by permission of the Director of the Bureau.

[1]See *Chem. & Met. Eng.*, vol. 27, No. 11, p. 546, Sept. 13, 1922.

7 shows that for any value of I which may be desired the smaller b is the less power is wasted in the cell itself. For this reason a small value of b is desirable. The equation also shows that the power expended in the cell increases as the square of the current flowing, which indicates that the importance of making b small in cells intended for ignition and heavy duty is greater than in the case of telephone and light-service cells. Certain practical limitations enter in fixing the resistance of the cells which show that excessive short-circuit currents are not a desirable feature.

Some dry cells which in the beginning show excessively large currents on short circuit may increase in resistance so rapidly that they will give less service than other cells of the same size, but having smaller initial currents. The tendency in this country toward cells of very large flash currents has been partly due to a mistaken idea that the more current that can be drawn from a cell the more service it will render. European cells generally are higher in internal resistance than American cells.

Internal Resistance of Dry Cells

From what has been said above about the resistance of the cell, it might be implied that b is a definite and constant physical quantity. Such, however, is not strictly the case. The resistance of a cell is ordinarily

$$\frac{E - E'}{I} = b \qquad (8)$$

but it can easily be shown that for various values of I different values of b are obtained apart from any consideration of polarization phenomena. By experiment it is found that the larger values of b correspond to the smaller values of I, but that for the currents ordinarily required of a dry cell the values of b are small and do not change very rapidly with changes in I. The practice of a few manufacturers to state the internal resistance of their dry cell to the thousandth part of an ohm is not to be commended, if it means nothing more than the open-circuit voltage divided by the short-circuit current, and it does not represent the resistance of the cell under working conditions.

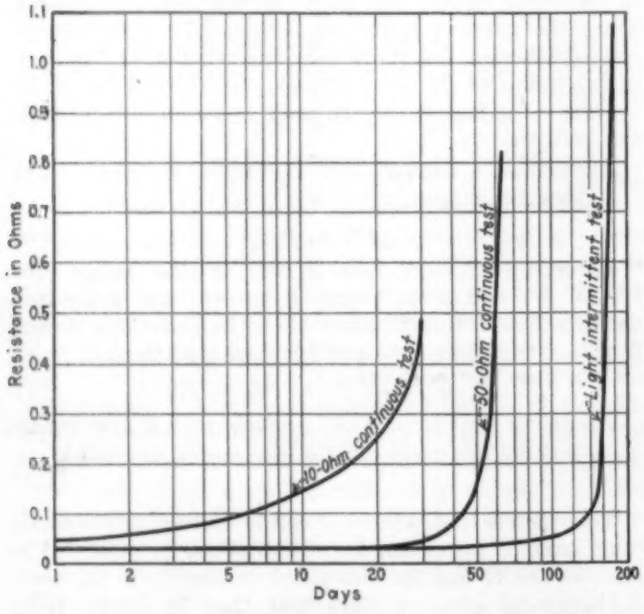


FIG. 10—PROGRESSIVE CHANGES IN RESISTANCE OF DRY CELLS MEASURED BY AN ALTERNATING-CURRENT BRIDGE IN SEVERAL TESTS

When the cell is new, the resistance b is ordinarily small, but it increases with the age and use of the cell. This is not due to the drying out of the cell by evaporation as is often supposed, although that may be a minor cause. The reactions of the cell due to the passage of electric current result in the formation of double chlorides and basic chlorides, which take up water in their formation and also clog the pores of the paper lining or paste, as well as incrust the surface of the zinc. In this way the available path for the flow of current is restricted and the resistance of the cell increased. As the cell is used, the MnO_2 is gradually reduced and the surface of the cathode moves inward. This makes the path between the zinc and the cathode a longer one, which also increases the resistance of the cell. The resistance of the cell increases slowly at first, but later increases very rapidly to large values. Fig. 10 shows the progressive changes in resistance of dry cells measured by an alternating-current bridge in the course of several tests. These curves are given for the 10-ohm test, a continuous discharge through 50 ohms and the light intermittent test.

Grouping of Cells

For most purposes dry cells are used in groups or batteries, the number of cells depending on the service required. It is desirable to arrange the grouping in such a way as to obtain the most economical service. Two factors are involved in arranging the cells; one

FIG. 11—CELLS CONNECTED IN SERIES

is the voltage requirement and the other the current requirement. When cells are connected in series—that is, when the positive pole of one cell is connected to the negative pole of the next and so on to the end of the row, Fig. 11—the voltage of the cells is additive. Two cells in series will give twice the voltage of one cell, and five cells will give five times the voltage of one, assuming that the cells, taken individually, are of the same voltage. If the voltage of one cell is E, the voltage of s cells in series is sE. When the cells are discharging, the voltage continually decreases. For this reason the number of cells required for a certain operation cannot be estimated on the basis of 1.5 volts per cell. The average working voltage of the dry cells may perhaps be taken as 1 volt per cell. If the voltage required is 4 volts, this means 4 cells in series. Another rule that is sometimes useful when the voltage requirement is not known is to connect cells in series, adding one at a time until the apparatus can be made to operate; then add an extra cell for each group of three or a fraction. This works out to give the same result in the example just given.

The rate at which the voltage will decrease when the cells are in use will vary with the current and duration of the discharge. A cell which will give 40 hours' service under normal conditions will not give 20 hours' service under twice the load. It may not give more than 10 hours. On the other hand, if the load is made very light, the service actually rendered may be small, because the deterioration of the cell becomes an important factor. As a guide to the proper use of the cell, information is given in Table VII.

The current drain on the cells can be relieved when

TABLE VII—CURRENT DRAINS FOR ECONOMICAL USE OF DRY CELLS

Duration of Daily Discharge, in Hours	Maximum Drain on Each Row of Cells In Series, In Amperes	Duration of Daily Discharge in Hours	Maximum Drain on Each Row of Cells In Series, In Amperes
16–24	0.02	½– 1	0.75
8–16	0.04	¼– ½	1.50
4– 8	0.08	⅛– ¼	3.00
2– 4	0.16	Few moments	10–15
1– 2	0.32		

necessary by arranging the cells in parallel, or as it is also called "multiple." Cells are arranged in parallel by connecting the like poles together. Fig. 12 shows cells connected in parallel.

When more than three cells are involved in a series and parallel connection, there is a choice of arrangement. The cells may be arranged in several rows connected in series and then these rows connected in parallel (Fig. 13), or they may be arranged in parallel groups which are then put in series (Fig. 14).

Mathematically, the result is the same in either case. The voltage of the battery as shown in both figures

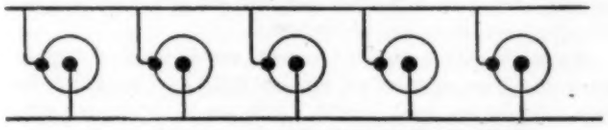


FIG. 12—CELLS CONNECTED IN PARALLEL

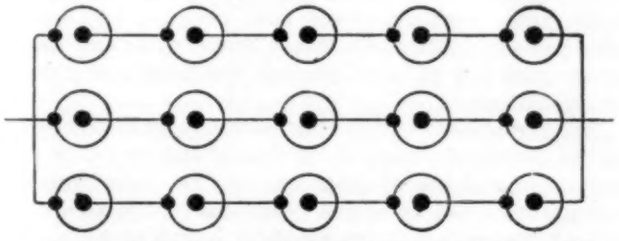


FIG. 13—PARALLEL OF SERIES-CONNECTED CELLS

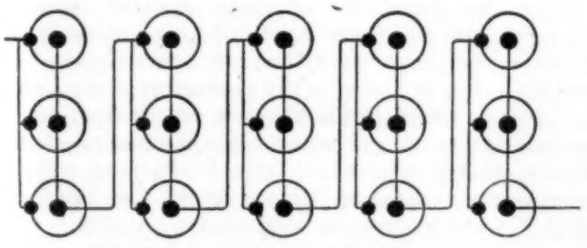


FIG. 14—SERIES OF PARALLEL-CONNECTED CELLS

is five times the voltage of a single cell, and the current furnished by any one cell is only one-third of the total current. The choice between the arrangements arises from the fact that one or more of the cells may fail before the others. For example, if any cell in each diagram should increase considerably in resistance, it would practically exclude one row of cells of the first diagram, Fig. 13, from service, reducing the battery to two rows. In the second case, Fig. 14, the battery would have four groups of three cells and one group of two cells, the effect of the bad cell being reduced to a minimum. In terms of resistance of the battery, the spoiling of the cell in the first diagram increases the resistance of the battery by 50 per cent, while in the second diagram it increases the resistance of the battery by only 10 per cent.

As the internal resistance of the dry cells increases, the current which they will deliver to any given circuit will decrease. If there are n cells, arranged s cells in series and p rows in parallel, the electromotive force of the battery will be sE, and if each cell has a resistance of b, the resistance of the battery will be $\frac{sb}{p}$. Applying Ohm's law to a circuit containing such a battery, equation 3 becomes:

$$I = \frac{sE}{R + \frac{sb}{p}} \qquad (9)$$

The maximum current that the battery can supply (when the external resistance is zero) is:

$$I = \frac{sE}{\frac{sb}{p}} = p\frac{E}{b} \qquad (10)$$

which is analogous to equation 4.

Whenever it may be necessary to use old cells for any purpose and the resistance of the cells has become of the same order of magnitude as the resistance of the external circuit, a choice arises between the series and parallel connections of the cells. If the resistance of the individual cells is less than the resistance external to the battery, more current can be forced through the circuit by putting the cells in series; but if the resistance of the individual cells is equal to the external resistance, the current is the same whether the cells are in series or parallel. If the resistance of the individual cell exceeds the resistance external to the battery, more current can be obtained by putting the cells in parallel.

Benzol Poisoning, Its Occurrence and Prevention*

By Charles F. Horan

Manager, Department of Hygiene and Safety, Hood Rubber Co., Watertown, Mass.

POISONING by industrial processes arise, for the most part, by the inhalation of the fumes. Because of its fat-dissolving qualities, benzol may also be absorbed through the unbroken skin, but it is doubtful if this mode of entry presents a serious hazard in industry. Lehman has shown that a man breathing a mixture of benzol and air actually absorbs 80 per cent of the benzol inhaled.

There seems to be some difference in the toxicity of pure and commercial benzol. The older reports indicated that commercial benzol was more dangerous than the pure, but the experience in the rubber industry would indicate that this conclusion was unfounded, there seeming to be a direct connection between the boiling points of the benzols and their ability to do harm; the compounds of lower boiling points appearing to be more dangerous than those of higher boiling points. This is probably due to the fact that the amount of vapor given off by the low-boiling point benzols is greater and thus a larger dose is breathed by employees exposed to the material. Considerable variations in individual susceptibility to benzol-poisoning exist, this being considered as the reason why the material has been used in some industries over a long period of time without serious symptoms having arisen.

Concerning this substance there is some division of opinion within the ranks of industrial hygienists as to

*Abstracted from paper read at the convention of the National Safety Council, Detroit, Mich., Aug. 30 to Sept. 1, 1922, inclusive.

its real dangers. There are those who consider the material with alarm and look upon all employees exposed to the vapors of benzol as being potential fatalities; there are others in industry who consider the vast amount of the material used and the relatively few cases of poisoning as evidence of lack of danger from benzol. These non-alarmists tell us that very few employees in industry are susceptible to benzol poisoning, and even in cases where little organized health protection is offered to employees using this material, cases of poisoning are rare and not usual happenings. They suggest to us that the statement "things are not what they seem" contains an element of truth; they remind us that industrial-accident statistics show the wheelbarrow to be more dangerous than the steam locomotive and the cement brush to be a greater fire hazard than the blowtorch.

In the central ground, and accepting the middle course, are those experienced industrial physicians and sanitarians who realize that the material is not nearly as dangerous nor as safe as some persons believe; that it can be used with relative safety only at the expense of the maintenance of certain precautionary measures.

Prior to 1914 several cases of benzol poisoning had been reported by Snelling. Three girls, aged from 14 to 16 years, were employed in a Maryland can factory in which the containers were sealed with a mixture of benzol, resin and rubber. Three other cases have since been reported from this factory. The most famous recorded cases of chronic poisoning were from a rubber tire factory in Sweden where nine young women, from 15 to 20 years of age, were taken ill with hemorrhages from the mouth, stomach, uterus and nose. Four of these girls died after an exposure to benzol lasting from 3 weeks to 3 months. In 1916 Dr. Alice Hamilton reported fourteeen new cases of sudden acute poisoning with seven deaths.

The reports of German factory inspectors for 1912 deal with three cases of poisoning, two of them being fatal. One man was employed in painting the interior of a barrel with benzol paint, another climbed into a washing machine in a dry-cleansing establishment and the third was employed in a distilling plant and forgot to turn on the cold water for the condensation. In 1918 British factory inspectors reported the case of a man overcome by benzol vapor while employed in a distillation plant. He was revived with oxygen and returned to work on the second day, only to be again overcome and die.

Recorded Cases of Poisoning

A number of cases of benzol poisoning have been recorded where employees were overcome while cleaning tanks in which benzol has been stored. In one case a benzol kettle had been empty for 24 hours, was washed out twice with steam and permitted to stand, filled with cold water, over night. As the workman went into the kettle a strong steam of air was blown in through a pipe. In spite of these precautions the workman was overcome, but was rescued. One of his fellow workmen who assisted with the rescue was overcome and died within 10 minutes.

One British case is recorded where a tank car was unloaded, washed with water, steamed out and then left, filled with water, for 20 hours; then washed twice with water, boiled for 12 hours and finally left for 10 days with a 16-in. manhole opened. A man who was then sent into the tank collapsed and, although he was revived in time, one of his rescuers died.

There have come to my personal attention, during the past 6 years, three fatal cases of poisoning to tire-builders in a pneumatic tire plant, one fatal and one acute case to female operatives in a thread-treatment room in a cord tire plant, one fatal case to a laborer engaged in digging a trench along a leaking tank of benzol, a fatal case to a foreman in a rubber-reclaiming department, three fatal cases in the coating room of an artificial leather factory, and about a dozen cases of less serious acute poisonings in a golfball department of a small rubber industry.

Condition of Temperature Is Important

So far as age is concerned, the very young, the old and the female seem to have particular susceptibility to the vapors of benzol. Debilitated conditions, organic diseases especially of the heart and kidneys, addiction to alcohol and excesses of all kinds materially increase susceptibility. Vigorous muscular individuals with rapid circulation and deep breathing are overcome more readily by benzol fumes because of the rapidity with which the vapors are absorbed.

As we would naturally expect, conditions of temperature and humidity effect susceptibility to benzol poisoning. Thus on hot, humid days, or in interiors where the air is hot and stagnant, poisonings are more likely to occur because of the greater volatility of the benzol under these conditions, and also, perhaps, because of retarded elimination, increased pulse rate, and hence the greater flow of blood through the lungs under these circumstances.

The symptoms of poisoning naturally vary according to the length of exposure, individual susceptibility and the amount of benzol absorbed. As Dr. Reifschneider will probably tell us of the symptoms of the poisoning in both the acute and chronic state, I shall pass along to the prevention of the poisoning.

From the standpoint of those engaged in safety work, the methods of prevention of benzol poisoning are of much more importance than any other phase of this problem. The first step in the prevention of the poisoning is to be found in the physical examination of each applicant for work and periodic re-examination of those exposed to the hazards of benzol. Persons suffering from organic diseases, especially of the heart and kidneys (which diseases tend to retard elimination), should not be placed on occupations where the exposure to benzol constitutes an occupational liability. Physical examinations should include a differential blood examination, an estimation of hæmoglobin and a determination of the coagulating time of the blood. Experience indicates that re-examination every 4 weeks is not too often.

Follow Up all Suspected Cases

All cases of absence from work should be investigated if the absence extends beyond 24 hours. In event of the employee being away from his occupation because of sickness, he should be visited by a physician familiar with the early symptoms of benzol poisoning. Note should be kept of the state of health of the workers, the results of periodic physical examinations, the duration of symptoms and the treatment of illnesses that occur. Care should be taken to have the records complete and entries such as "coagulating time, normal," should be discouraged. Employees should be encouraged

to use the factory dispensary in event of illness and it scarcely requires to be said that medical aid should be within easy reach.

We have now come to the subject of the education of the worker. In the prevention of occupational diseases the co-operation of the employee is indispensable and is the most important condition of an effective defence. The best regulations and preventive measures are worthless if the worker does not observe them. The employee should be advised as to the dangers incidental to his employment and he should be acquainted with the symptoms which demand early medical attention; he should be taught the aims of the management with reference to the prevention of industrial poisoning.

Fumes Must Be Driven Off at Bottom

Dr. Hamilton reports a procedure at the Gary plant of the United States Steel Corporation in connection with safety in cleaning apparatus which has been used in the manufacture or storage of benzol: After washing out the empty tank and steaming it a cage of white mice is lowered into the tank. If the mice are overcome by the gas the flooding and steaming are repeated until the mice show no effects of the benzol. The use of a portable electric-driven gasblower to exhaust air through the drain pipes of tanks has been of much value. Because of the benzol vapor being heavier than air, it is necessary to exhaust at the bottom of the tanks, and drain pipes are conveniently located for this purpose.

Where benzol is used industrially as a solvent, it has been found necessary to install general room ventilation, rather than hope to confine the ventilation to a small number of exhaust hoods. In a scheme of general room ventilation it is well again to remember that benzol vapor is heavier than air and should be exhausted at the floor level. Our experience illustrates that an air change of thirty times an hour is desirable and that the flow of air toward the floor should be not less than 6 ft. per minute. The British standards in rooms where airplane wings are "doped" concurs with our ventilation of thirty changes an hour.

In conclusion, permit me to say that with an efficient method of physical examinations, with regular reexaminations; the changing of an employee's occupation as quickly as he shows either an abnormal reduction in number of blood cells or an unusual increase in coagulating time; together with adequate ventilation, benzol not only can, but is, being used without danger. If managements and employees are willing—and most of them are—to maintain reasonable safety requirements, benzol will continue to be a cheap and powerful solvent and need not be the cause of needless sickness or death to employees in industry.

Bricks From Dolomite

At the Columbus, Ohio, ceramic experiment station, the Bureau of Mines has made standard sized bricks from calcined dolomite and from raw dolomite, using 10 per cent of the flux Fe_2O_3, Al_2O_3, SiO_2. Calcined dolomite was found undesirable for making into bricks, as the mud slakes so rapidly, and all samples cracked badly on account of enormous shrinkage during drying and burning. Raw dolomite, together with 10 per cent flux, gives excellent promise. The bricks so burned to 1,450 deg. C. were sound, of high density and have not yet shown signs of slaking when subjected to the boiling test.

Grinding Cracks

A RATHER mysterious defect—almost always charged against incorrect heat-treatment—often appears as a close network of fine cracks covering a hardened article after finish grinding, causing large losses in rejections. A practiced eye can see faint "ghosts" of such markings on an apparently perfect surface. Pickling in 10 per cent sulphuric acid brings out the defect very plainly, developing the latent cracks rapidly (Fig. 1).

Messrs. Guillet, Galibourg and Beuret have investigated this matter and show how they were able to prevent the trouble, in *Revue de Métallurgie*, 1921, p. 213. They call attention to the fact that it is a quite different phenomenon to the exfoliation or flaking away of considerable areas of carbonized surfaces. Giolitti has investigated this, and ascribes it to sudden variations in carbon content in successive layers of the cemented zone. Messrs. Hanson and Hurst[1] think grinding cracks are due to segregation of free cementite in a thick network; when this was suppressed, rejections in a hardened ground 2½ per cent nickel steel were reduced to one-tenth their former number. Impurities in the steel also are thought to have some influence; furthermore, local heating during finishing must be avoided. Other authors have called attention to the great similarity which exists in the appearance of grinding cracks to the fine surface cracks on a wheel-burnt rail (shown by J. E. Howard[2] to be due to rapid heating under a slipping engine driver and sudden chilling by conduction) to the cracks appearing on steel mill rolls and to the cracks in the bore of large caliber guns.

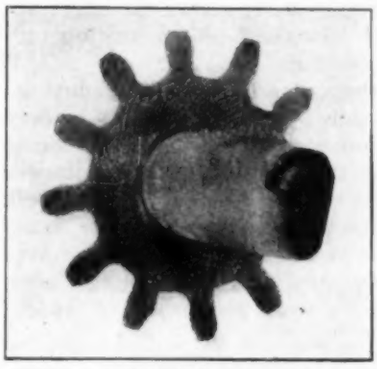


FIG. 1—GRINDING CRACKS DEVELOPED BY PICKLING THE SURFACE OF A HARDENED PINION

Many possible factors during heat-treatment or grinding might be responsible for the defect, but on account of the similarity with other imperfections found after close study to be due to transient overheating, the French authors decided to study the grinding process. Furthermore, a piece, uniformly carbonized and hardened, will show indications of cracking in certain places where the grinding conditions varied slightly. For instance, a closer network of cracks always occurs at the ends, where the wheel begins its work. Plane surfaces also seem more susceptible to the fault than cylinders. It is also very significant that whereas the specimens are file hard before grinding, those which develop cracks may easily be touched by the file after grinding. This alone would seem to indicate that they have lost some of the surface properties acquired by case-hardening, and this could best be explained by a slight heating during grinding.

To test these suppositions, a cylinder of low-carbon steel was carbonized to about 1 mm. depth over half its length only. The entire specimen was then quenched

[1] *J. Iron & Steel Institute*, 1919, I.

[2] Report to Interstate Commerce Commission on accident at Glenwood, W. Va. Abstracted in *Chem. & Met. Eng.*, May 11, 1921.

TABLE I—EXPERIMENTS ON PINIONS

Anneal	Speed of Part, r.p.m.	Result
30 min. at 150 deg.	500	No cracks on flat or shaft
30 min. at 150 deg.	120	Deep cracks on all surfaces
None	500	No cracks on flat or shaft
None	120	Deep cracks on all surfaces
None	120 (new wheel)	Deep cracks on all surfaces
None	120 (dirty wheel)	Deep cracks on all surfaces
None	440 (dirty wheel)	No cracks on flat or shaft

for maximum hardness, and ground from end to end. After pickling, cracks appeared on the carbonized end only. That part, on being broken, showed the usual coarse crystalline core, the fine crystalline muff, and, in addition, a very thin surface layer, colored bluish in tint. A micrograph of the surface layer where it was not carbonized (Fig. 2) clearly shows the effect of surface heating by the incipient decomposition of martensite areas into troostite.

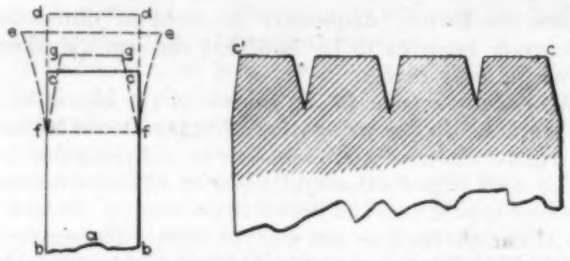
Acting on the idea that superficial heating during grinding is responsible for the surface cracks under investigation, it was found possible to avoid them entirely by speeding up the rotation of the cylinder as high as possible. It is easy to see that this reduces not only the time the wheel is in contact (and the steel is being heated) but the time elapsing before the hot metal is cooled by being struck by the cooling fluid.

A number of experiments were performed, of which the following are typical:

Fifty-two bars of medium carbon crucible steel (made of blister bar) were selected. Bars 1 to 28 were carbonized 0.5 mm. and the others 1.0 mm. deep. All bars were quenched from 800 to 825 deg. C. Bars 1 to 15 and 29 to 40 were then tempered 30 minutes at 150 deg. C. Finally each lot was divided, one part being ground at 120 r.p.m. and the others at 500 r.p.m. The striking result followed that *all* bars ground when revolving at 120 r.p.m. developed quenching cracks, and *none* appeared in those ground when revolving at 500 r.p.m., notwithstanding the large variations in previous heat-treatment.

A number of hardened pinions were then studied, like those shown in Fig. 1, and which had always given

FIG. 2—DECOMPOSITION OF MARTENSITE NEAR SURFACE OF LOW-CARBON CYLINDER, QUENCHED AND GROUND



FIGS. 3 and 4—MECHANISM OF SURFACE CRACKING CAUSED BY TRANSIENT OVERHEATING

great trouble by cracking both on pinion and shaft. Table I contains the results. If the speed of the piece being ground is high enough, it seems that the condition of the grinding wheel is also only a minor factor.

Finally, it was found possible to develop the same kind of cracks at will, and without grinding, if a little molten copper be poured on a flat hardened surface, and then immediately drenched with a strong water jet.

The mechanism of the action has been explained by the late Prof. D. Tchernoff, in a paper entitled "On the Erosion of Steel Guns by Powder Gases."[1] While the tube is filled with the hot compressed gases resulting from an explosion of powder, the extreme surface of the metal is very highly heated, but almost instantly cooled after the escape of the gas by the conduction of the heat back into the underlying metal. If an elementary prism of metal supposed to be free of surroundings is heated on the end surface *cc* (Fig. 3) in the described manner, it would expand to a shape like *bfeefb*. On the other hand, if it were held in sidewise constraint, as it would be in a gun tube, the shape assumed during the transient heating would be *bddb*. It is apparent that if the heating has been high enough, the surface layers will be overstrained in compression and the metal at the surface will be plastically deformed. During cooling, therefore, the surface *dd* will contract more than enough to relieve the induced compressive stress and a state of tension will exist in the cold surface, now slightly higher than the original *cc*, which causes ruptures and radial cracks. The net result of this cycle of operations is shown in Fig. 4.

Italian Manufacturers of Tartaric Acid Merge

Commercial Attaché H. C. MacLean reports from Rome the announcement of a merger that has been effected under the auspices of the Credito Italiano between four important Italian companies manufacturing and trading in tartaric acid. The Societa Anonima L'Appula, whose main office is at Bari, has increased its capital to 25,000,000 lire, and has absorbed the Fabbrica Lombarda di Acido Tartarico, the Societa Anonima Industria Acido Tartarico and the Societa Italiana per i Derivati delle Cellulosa. The three latter companies have already ratified the conditions under which the merger will be effected.

Welding Cast Iron With Thermit

It is recommended to preheat cast-iron parts to be welded with Thermit no higher than a dull red heat. This is sufficient for perfect fusion with the hot metal being added. It has also been found that the total contraction of both cast iron and weld metal is sufficiently close so that there is little danger of hairline cracks perpendicular to the plane of break.

[1] *Revue de Métallurgie*, 1915.

Synopsis of Recent Chemical & Metallurgical Literature

Peanut Oil Industry as a Source of Byproducts

The commercial production of peanut oil, which has developed rapidly since 1915, has resulted in the appearance on the market of large quantities of byproducts that are used principally as feeds for livestock. One reason for the phenomenal growth of the industry is that the peanut can take the place of cotton as a cash crop in regions where the weevil has made the growing of the fiber crop unprofitable. The peanut has been a boon to the oil millers as well as to the planters, for the oil is produced in the same mills that are used for extracting cottonseed oil.

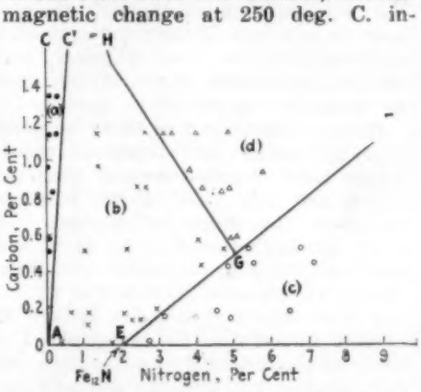
The processes of making peanut oil and the byproducts are described in Department Bulletin 1096, "Byproducts From Crushing Peanuts," by J. B. Reed, of the Bureau of Chemistry, just issued by the United States Department of Agriculture. The principal products other than the oil are peanut-oil cake, which is defined as the residue after extraction of part of the oil by pressure or solvents from peanut kernels, peanut-oil meal, which is the ground peanut-oil cake, and unhulled peanut-oil feed, which is the ground residue obtained after extraction of part of the oil from whole peanuts. The ingredients of the last-named feed must be designated as "peanut meal and hulls." Theoretically peanut-oil meal, which is made from the kernels after a part of the oil has been extracted, should contain no hulls, but because commercial methods cannot remove all the hulls, it is necessary to permit a small amount of hulls in the meal in order that the definition may be practical.

The bulletin contains detailed information and analysis of the different kinds of feeds and formulas for determining the percentage of hulls. Much of the information is technical and of interest only to feed analysts and officials having to do with the enforcement of feed laws.

Nitrogen in Steel

A series of steels and ore sample of cast iron were nitrogenized by Kiyoshi Kido[1] to various degrees by beating pulverized samples in a current of dry NH_3. They were then compressed in a small copper tube and magnetization-temperature curves obtained upon heating. One heating only was possible, since the alloy becomes unstable at temperatures higher than 700 deg. C.

Four magnetic change points were noted in addition to the well-known A_0 of cementite at 215 deg. C., and A_2 of ferrite at 750 deg. C.—viz., at 250, 350, 470 and 620 deg. C., respectively. Researches of Tschischewski[2] have given evidence of the existence of two nitrides $Fe_{12}N$ and Fe_2N. Low-carbon iron containing about 2 per cent N shows its most important magnetic change at 470 deg. C. This has been ascribed to $Fe_{12}N$. As the amount of N in low-carbon steel rises still further, another magnetic change at 250 deg. C. increases in importance—it is thought to be due to Fe_2N. The two other changes are ascribed to unknown "double carbides." The accompanying diagram shows the constitution of various alloys as determined in this manner.



Low-Pressure Absorption of Gasoline From Natural Gas

Many recent and surprising developments in low-pressure absorption practice for the recovery of gasoline from natural gas and the growing reluctance of certain purchasers of refined or partly refined products to take blended gasoline convinced the petroleum division of the Bureau of Mines that a detailed description of a large plant treating rich casinghead gas at low pressure would be of aid to the industry. Although the product of the plant described in this paper is blended, it has such a vapor pressure that blending is not necessary. Technical paper 263, by W. P. Dykema and A. A. Chenoweth, is entitled "Design and Operation of a Low-Pressure Absorption Plant."

This report deals with the construction, the operating methods, the many changes necessitated and the difficulties encountered in the recovery of gasoline from a rich casinghead natural gas by absorption at low pressure. The results of heat generated in the absorption towers are particularly noted, and a possible means of overcoming the undesirable effect of such heat is proposed.

The plant referred to was installed during the winter of 1916-17 in the Cushing oil field in Oklahoma. Far from a perfect result has been achieved in the plant; nevertheless a more or less detailed statement of the main features of the plant and its operation will probably interest, and, it is hoped, aid those persons operating or designing absorption plants to treat similar gases. The plant was designed and is operated as a low-pressure installation, the specification for the absorption tower calling for steel work to sustain a maximum pressure of 15 lb. per sq.in. The gas used comes from approximately thirty wells, drilled to the Bartlesville sand and producing oil and gas of good quality.

Part I of this paper includes a detailed outline of the plant and its regular operation with records of temperatures, pressures, production and changes in equipment. Part II considers data on the latent heat of absorbed gases and a proposed means of overcoming the increase in temperature of the oil as it circulates through the towers.

The paper may be obtained by applying to the United States Bureau of Mines, Washington, D. C.

The Quality of Motor Gasoline

For several years the Bureau of Mines has conducted surveys to determine the changes in motor gasoline being sold throughout the United States. The results of the sixth semi-annual survey are presented in the August *Reports of Investigations* (Serial No. 2,388) by A. D. Bauer, assistant petroleum chemist, and N. F. Le Jeune, assistant chemist.

The present survey shows that for the districts in which samples were collected the average gasoline is becoming more volatile instead of less so, as is sometimes supposed. This year's gasoline is much more volatile than that sold 2 years ago, and it has a somewhat better distillation range than last summer's samples. A comparison of the average figures for several years shows that motor gasoline is also becoming more uniform in character. The large seasonal change is disappearing, but "winter gasoline" still has a lower initial boiling point than "summer gasoline." This difference in volatility is made intentionally to facilitate starting the motor in cold weather. The end point shown in the present survey is slightly lower either

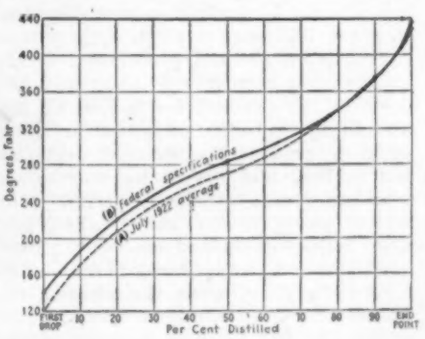


Fig. 1—Distillation curves for (*A*) Average quality of gasoline sold in July, 1922, and (*B*) gasoline meeting federal specifications.

[1] *Science Reports*, Imperial Tohoku University, vol. 10, p. 471.

[2] *J. Iron & Steel Inst.*, 1915. II.

than that of last winter or of the summer of 1921.

The average of the entire country considered as a whole does not show much change from a year ago, but samples from individual cities show some distinct changes. The average figures for Denver show that the initial point is lowered 15 deg. F., the 90 per cent point 14 deg. F. and the end point 21 deg. F., whereas the 20 and 50 per cent points increased 11 and 13 deg. F. respectively. This change may be due to the fact that Denver receives gasoline from one group of refineries at one period and from another group at other times. Of 132 samples collected in the present survey, ten failed to meet federal specifications (adopted Nov. 25, 1919) as regards the initial boiling point of 140 deg. F., and 61 samples failed at the 90 per cent point (374 deg. F.).

The city of Bartlesville, Okla., is included in the present survey, as it is in the center of the mid-continent field. The actual specific gravity at 60 deg. F., the corresponding A.P.I. gravity, the initial boiling point or first drop, the 20, 50 and 90 per cent points, the end point and average boiling point, and the percentage recovered in the receiver were determined and tabulated for each sample.

A distillation curve representing the average figures for the July, 1922, survey, and a curve showing motor gasoline meeting federal specifications are to be found in Fig. 1.

Brittleness of Tin Foil

Some interesting investigations on aluminum containing tin have been carried out by E. Heyn and E. Wetzel of the Kaiser Wilhelm Institut für Metallforschung at Neubabelsberg and have been published in the *Proceedings* of this Institute, and summarized in *The Engineer* for Aug. 18, 1922. The investigations arose from the attempts to elucidate the origin of the brittleness of certain tin foil, which when freshly rolled was as soft and pliable as the average material, but which after a few days became through and through brittle. The origin has been traced to a small amount of aluminum contained in the tin. Even 0.25 per cent of aluminum is sufficient to make the tin completely brittle in a short time, so that the foil breaks up on the slightest bending stress. The effect is probably due to great difference in electrolytic potential between tin and aluminum, which under moist atmospheric conditions results in the gradual conversion of the aluminum to aluminum oxide. The splitting process always commences at the surface and makes its way down into the center of the material. Tin which, owing to the above cause, has been rendered useless can be regenerated and completely freed from aluminum by melting, when the alumina remains as a gray residue. The addition of lead to the tin does not retard the advent of the brittleness, but the addition of 2 or more per cent of copper is advantageous.

Book Reviews

FLUIDITY AND PLASTICITY. By *Eugene C. Bingham.* 440 pp., no illustrations. New York: McGraw-Hill Book Co., Inc. Price, $4.

The author has brought together and attempted to co-ordinate the vast amount of information on the flow of materials under shearing stress which has hitherto been scattered through the journals; and the resulting volume is valuable and welcome. The subject matter falls into two categories—namely, instruments and methods for measuring rates of flow, together with the necessary mathematical theory; and the relations of the results of such measurements to the physical and chemical properties of the various fluid or semi-fluid materials in question.

It is in the second of these subjects that the author, as a chemist, seems to be most interested and most at home, and this part of his work is therefore the more satisfactory. A great number of interesting facts and relationships are described and such theory as is available or as the author has been able to devise for himself is used to systematize the material. The theoretical reasoning is sometimes not very convincing, and the author's enthusiasm over a pretty idea is apt to make him forget that what was a hypothesis on one page does not become a certainty merely by turning over a few pages and writing it down again. Furthermore, it is often quite impossible to tell, without referring to the original papers, how much of the argument is the author's and given on his own responsibility and how much is quotation. For while an admirable feature of the book is its very extensive bibliography and author index, the references given in the text are usually so vague and indefinite that one does not know just where to look or whether it is worth while to look at all.

For some readers these would be serious faults and in fact to get the best out of the book the reader should be sufficiently mature to have a good deal of critical judgment and be well past the stage of accepting things because they are written down as if with authority. But if the book is regarded in its proper light, not as a treatise or handbook but as a guide to the study of the relations or fluidity and plasticity to other properties, it will be suggestive and stimulating as well as extremely useful.

Since fluidity and plasticity are purely mechanical properties it is not to be wondered at that the discussion and theoretical treatment of instruments and methods of measurement are less satisfactory than the physico-chemical part of the work. The author does not exhibit the precision of thought necessary to the satisfactory exposition of this part of his subject matter. He is often careless or inconsistent about definitions, notation and the use of words. For example, shearing stress, which is the most fundamental and important of all the quantities with which he has to deal, is sometimes called shearing "force," but almost always "shear," which means something quite different.

As regards methods, the author confines his attention almost exclusively to the capillary type viscocimeter with which his own very extensive experimental work has been done. His discussion of the theory of this instrument is passable. He makes the common mistake of supposing that the entrance correction treated by Boussinesq is a part of the kinetic energy correction, but this makes no difference in the practical application of the equations. When he comes to his own particular specialty, the flow of "plastic" materials through capillary tubes, his disregard of logical accuracy is more injurious to his result; and his most trusted formula, equation 89, p. 225, is mathematically incompatible with the hypothesis from which it is supposed to follow (equation 73, p. 217). The theoretical treatment is defective and unsatisfactory in several other respects, as well.

But after mentioning some of the more striking faults of the book and hinting that the author's English is sometimes decidedly queer, the reviewer gladly returns to the earlier point of view, that the merits of the book far outweigh its defects. It might have been better done, but it is well worth having as it is, and the chemical public should be grateful for this monument to the author's industry.

EDGAR BUCKINGHAM.

Recent Chemical & Metallurgical Patents

American Patents

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

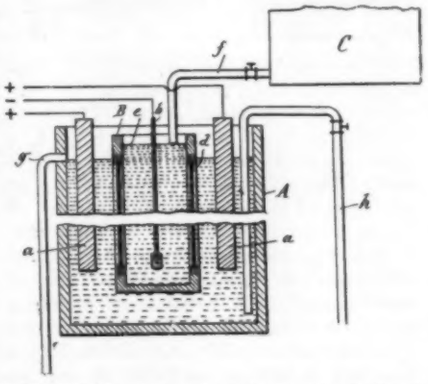
Aluminum Plating—Anselmo Ortiz, of Bayonne, N. J., notes that previous attempts to produce an aluminum coating on iron or steel articles by the hot-dipping process have resulted in a very rough surface (due to corrosion at very high temperature), or a coating consisting not of pure aluminum but an aluminum-iron alloy (when working at moderate temperatures). He proposes first to clean the steel article by pickling in 50 per cent ammonium citrate, washed and dried. Then it may be covered with a flux—a mixture of KCl, NaCl and $ZnCl_2$ melting below 600 deg. C. The aluminum is melted under a reducing atmosphere, held at 650 deg. C. or somewhat higher, and skimmed. The iron article is dipped into the bath at a rate just great enough so that the meniscus, where the aluminum wets the iron, is neither destroyed nor inverted. Its presence proves the wetting of the iron by the

aluminum, and insures that oxides or dirt at the junction will be removed from the contact. Under these conditions the steel will join to a smooth aluminum coating through a transition alloyed zone. (1,409,017; assigned to General Electric Co. March 7, 1922.)

Projectile Manufacture—John L. Cox recommends the following schedule of heat-treatments for armor-piercing shell made of nickel-chromium steel: After forging, cool quickly, at least through the critical range. Refining is done by reheating somewhat above Ac_3 and cooling rapidly to below the transformation. Grain refining preparatory to machining is done by reheating above Ac_3, cooling quickly to below Ar_1, reheating to just below Ac_1 and then cooling slowly. After rough machining, further grain refinement is done. Depending upon the caliber, it is reheated once or twice to 130 deg. C. above Ac_3, each time cooling rapidly through the transformation. Next a similar treatment is given 75 deg. C. above Ac_3. Maximum toughness is then acquired by quenching in warm water from 75 deg. C. below Ac_1, removing the projectile while fairly warm, to prevent cracking. Finish machining can then be done. Final hardening is done thus: First preheat the whole to just below Ac_1; then heat the forward part above Ac_1 by immersing the head gradually in a lead bath. It is then quenched by water jets to 120 deg. C. Immediately it is drawn for several hours in a bath of oil at 100 to 200 deg. C., depending upon the caliber and the composition. After cleaning, the base of the projectile is gradually immersed in molten lead, and drawn to about 70 deg. C. below Ac_1, then quenched in a water spray operating on the base only, so that a band of hot metal below the hardened point is untouched by the water. Then invert the projectile in a shallow bath of water, to keep the point cool. (1,407,254 and 255. Feb. 21, 1922.)

Alumina From Impure Ores—R. S. Sherwin of East St. Louis, Ill., claims that pure alumina may be recovered from low-grade bauxite, clays or aluminum-bearing residues from present processes as follows: Grind the raw material with enough lime to form $CaO.SiO_2$ with the contained silica and about one-half as much soda ash as necessary to make $Na_2O.Al_2O_3$ with the contained silica. The mixture is then sintered, and the clinker ground. Leaching with sodium hydrate solution (containing 4 molecules NaOH for each molecule of Al_2O_3) then removes the soluble aluminate, and leaves behind most of the insoluble lime silicate, if the temperature is maintained between 180 and 200 deg. F. Some silica also goes into solution, and it can be removed by digesting 2 hours in an autoclave at about 290 deg. F. Complete removal (requiring a longer time) is not required unless the Al_2O_3 is to be removed from solution by CO_2 gas. A somewhat more impure solution is suitable for the Bayer process (which precipitates Al_2O_3 by inoculating the solution with freshly precipitated $Al_2(OH)_6$ and agitating about 3 days). Alumina is then filtered off, enough of the solution evaporated to dryness to provide sodium for subsequent furnace charges, and the remainder used for another digestion. (1,422,004; assigned to the Aluminum Co. of America. July 4, 1922.)

Electrolytic Nickel—N. V. Hybinette, of Christiania, Norway, patents an improvement in his process for recovery of nickel from copper-nickel anodes (805,969; Nov. 28, 1905). As in the earlier patent, the cathode compartment *B* (see fig.) is supplied with fresh, pure nickel sulphate solution. Instead of maintaining this strictly neutral, a solution at 55 deg. C. containing 50 grams nickel sulphate and 2 grams H_2SO_4 per liter is introduced. The diaphragm *d* is not so porous as formerly, but is made of heavy cotton cloth, which permits the free SO_4 ions to migrate outward very rapidly; thus the actual conditions within compartment *B* are substantially neutral.



Maintaining a hydrostatic head of about an inch causes sufficient outward flow of liquid to prevent any copper entering the cathode compartment. Overflow electrolyte is withdrawn through *g*, and somewhat more impure liquid through *h*. This circulating liquid is purified of copper by cementation on nickel, of iron by reaction with nickel oxide, and the acid concentration is rebuilt by depositing nickel in a similar cell having insoluble anodes. Copper-nickel anodes made in an electric furnace have been found to be superior to the blast-furnace product, being denser and lower in iron and sulphur. (1,395,827. Nov. 1, 1921.)

Furnace Refining of Copper—Oliver C. Martin, of Richmond Hill, N. Y., patents an arrangement for refining copper. He utilizes a reverberatory furnace for continuous melting of cathodes or pigs of impure metal. These are side-charged, to protect the furnace walls and without opening the furnace, and the molten metal is drained out the end of the furnace as it is formed. Thence it is laundered into one of three furnaces built much after the style of a Pierce-Smith converter. These three are mounted symmetrically on a large turntable; while one is filling the second is poling and the third pouring into a casting machine of approved type. All furnaces are connected to waste-heat boilers. By means of such continuous operations, many economies may be effected. (1,400,892; assigned to Nichols Copper Co. Dec. 20, 1921.)

Manufacture of High-Silicon Sheets—Andrew Pinkerton, of Ben Avon, Pa., proposes to make high-silicon sheets (for electrical apparatus) of uniform thickness and having surfaces which will not peel and crack when the sheets are bent or sheared as follows: After the cold-rolling operation the sheets are pickled, washed and annealed. Pickling is necessary to remove the scale, but if this operation is done on annealed sheets, it requires much time and acid, and results in a very rough surface. (1,396,052; assigned to American Sheet & Tin Plate Co. Nov. 8, 1921.)

Regenerator for Furnaces Fired With Cold Dust—Paul Kühn, of Dortmund, Germany, proposes to avoid slagging in the checkerwork by coal ash as follows: Dusty gas leaves the furnace and passes through downtake and slag pocket in the usual way. The first section of the regenerator is built with sloping floor (and preferably on a movable sole plate so it can be quickly replaced). In action the dust is supposed to collect in these sloping flues and drip back into the slag pocket, from which the liquid is tapped periodically. The second portion of the regenerator is built at an angle with the first and has horizontal checkers from which, the inventor states, any dust which collects may be removed in powdered or granular condition. (1,421,259. June 27, 1922.)

Dichlorethylene—Felix Kaufler, of Munich, Germany, has patented the principle of converting tetrachlorethane to dichlorethylene at atmospheric pressure by passing it in gaseous form over a metallic catalyst with steam. It is said that the yield of crude dichlorethylene amounts to 88 per cent of the theoretical maximum. On fractional distillation, this crude product gives about 90 per cent of dichlorethylene which boils at 48 to 60 deg. C. The residue is unchanged tetrachlorethane. The process is assigned to the firm Dr. Alexander Wacker Gesellschaft für Electrochemische Industrie, Munich. (1,419,969. June 20, 1922.)

Black Powder—The use of artificial graphite from old electrodes, crucibles, etc., for glazing black powder is covered in a disclosure made by John R. Mardick, of New York City, and assigned to the Acheson Graphite Co., of Niagara Falls. It is claimed that when such waste graphite products are ground finely and used instead of natural graphite for glazing black powder grains it gives a more uniform covering and improved moisture resisting qualities, as well as increased sensitiveness, uniform progression of fire, and uniform velocity of explosion. (1,415,889. May 16, 1922.)

British Patents

For complete specifications of any British patent apply to the Superintendent, British Patent Office, Southampton Buildings, Chancery Lane, London, England.

Formaldehyde—Formaldehyde is produced by passing carbon monoxide, hydrogen and water vapor over a contact substance at a temperature of 240 to 350 deg. C. Suitable contact substances are unburnt porcelain, pumice, asbestos, coke or charcoal, preferably coated with a metallic deposit of copper, nickel, etc. (Br. Pat. 179,951. A. Heinemann, Berlin. July 5, 1922.)

Rustproof Steel—A coating composition to be applied to steel and iron surfaces to prevent rust and to convert existing rust into an inert form comprises an oxy-acid of phosphorus, an oxide of hydrate of chromium and a solvent of these, with or without oxides, hydrates or chromates of manganese, lead or nickel. According to one example, a mixture of lead oxide and orthophosphoric acid is dissolved in a mixture of wood spirit, acetone, ethyl alcohol and methylated spirits, and a mixture of chromium oxide and phosphorus acid is added thereto. According to another example, chromic hydroxide is digested in 24 hours with boiled linseed oil or other drying oil, with or without heating, orthophosphoric acid is then added and the mixture is agitated. Pigments possessing rust-reducing properties may be added. The composition after drying may be covered with a coating of paint, varnish, enamel or the like. (Br. Pat. 179,811. G. H. Howe, Birmingham, England. July 5, 1922.)

Paper Pulp—In the preparation of paper pulp from papyrus, the material is first boiled, steeped or retted, and then subjected to mechanical pressing with simultaneous washing to remove the pith, and then beaten to pulp. The removal of the pith may be effected during the pulping, the mechanical pressing being omitted. A preliminary grading may be effected by splitting off the bark either before or after the boiling or steeping. The waste products, mainly pith, are in wet condition subjected to great pressure, and formed into briquets, cakes, etc., in quantity sufficient to supply the entire fuel for the requirements of the process. (Br. Pat. 180,097; H. Steinhilber, Berlin. July 12, 1922.)

Aluminum—Aluminum is obtained by electrolysis of fused alumina mixed with barium oxide or metallic barium. Cryolite and fluorite may be added as fluxes. In an example, the alumina is first fused and barium oxide mixed with 10 per cent of powdered or fine-grained aluminum is then added, the addition being one-sixth of the weight of alumina. A little fluorspar may also be added. The bath is raised to 1,200 deg. C. by the oxidation of the aluminum and the reduction of the alumina by electrolysis then proceeds. In subsequent operations alumina is added and after fusion, aluminum mixed with a little alumina is also added, no further addition of barium oxide being necessary. Fluxing material is added to replace that volatilized. With a furnace containing 30 kg. of alumina using 20,000 amp. at a pressure of 7 volts, at least two operations per hour may be effected, each yielding 15 kg. of aluminum. (Br. Pat. 180,326, not yet accepted; M. Blasi, Barcelona, July 12, 1922.)

Extracting Vegetable Oils—Oils and fats are extracted from oleaginous vegetable matter by subjecting it, with or without previous preparation such as grinding, to the action of just sufficient solvent to soak it and then extracting the solvent and oil together under low pressure, say 1 to 10 kg. per sq.cm.

FIG.1.

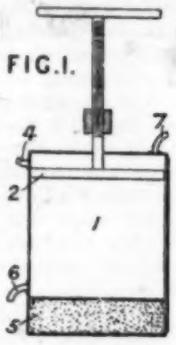
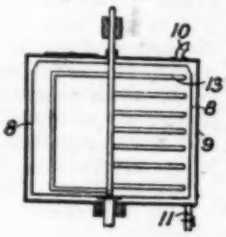


FIG.2.



The temperature of operation is kept below that of volatilization of the solvent, for example, 30 to 75 deg. C. In one form of apparatus, Fig. 1, a vessel 1, provided with a plunger 2, is used. The solvent is introduced by an inlet 4, and the oil and solvent run off through an outlet 6. The residual cake 5 may be heated to drive the solvent off through a pipe 7. Another form of apparatus, Fig. 2, consists of a rotary extractor 8, provided with an oppositely rotating agitator 13, and inclosed in a chamber 9 having an inlet 10 and an outlet 11. After soaking for, say, 10 to 20 minutes, the vegetable matter is subjected to rotation at a speed corresponding with the low pressure desired. (Br. Pat. 179,931; not yet accepted. Cellulose et Papiers Soc. de Recherches et d'Aplications, Paris. July 5, 1922.)

Formaldehyde—A gaseous mixture of carbon monoxide and hydrogen—for example, suction or water gas—is forced under pressure through a catalytic mass consisting of a hydrogen-activating catalyst such as nickel or cobalt and a hydrated metal oxide such as alumina or rare earths, the activity of the mass being maintained either by the introduction of steam into the gaseous mixture or by periodic treatment with steam. Formaldehyde is removed from the product by scrubbing with water; the residual gas, which contains methane and hydrogen, is of value as an illuminating gas. (Br. Pat. 180,016; E. J. Lush, London. July 12, 1922.)

Alcohol—Ethylene is removed from industrial gases by passing them through warm concentrated sulphuric acid containing as catalytic material a lower oxide or salt of a metal possessing more than one valency—namely, iron, cobalt, nickel, cerium, manganese, chromium, copper, lead, mercury, titanium or tin; the resulting ethyl hydrogen sulphate is then hydrolyzed in the known manner to produce alcohol or ether. Ferrous sulphate, cuprous chloride, copper sub-oxide and cuprous sulphate are specifically mentioned as catalysts; higher oxides and salts of the metals may be employed, provided that a reducing substance be present. The catalysts are insoluble in the sulphuric acid and are recovered from the product for re-use. The industrial gases referred to comprise natural gas, coke-oven gas, illuminating gas, gases obtained by cracking oils, schist gases and synthetic ethylenes. Preferably they are first freed from benzene, ammonia, water, sulphur compounds, acetylene hydrocarbons and ethylene homologs. An example is given of the recovery of ethylene from illuminating gas by passing the purified gas through a column containing pumice in which circulates sulphuric acid of 66 deg. Bé. containing 4 per cent copper sub-oxide and maintained at a temperature of 35 to 40 deg. C. (Br. Pat. 180,988; not yet accepted; A. A. L. J. Damiens, Seine, France. July 26, 1922.)

Destructive Distillation.—The destructive distillation of fuel, more particularly peat, is effected in ovens which are connected and operated after the manner of a continuous kiln. The apparatus comprises a number of chambers arranged in "ring" formation and heated by external flues in which are vertical partitions having openings alternately at top and bottom. In operation, one section of the chambers will be cooling off after firing, the cooling being effected by air which is passed through the flues on its way to the adjacent firing section. From this section the products of combustion are passed through the flues of other chambers in which the charges receive a preliminary heating. The operation is so controlled that a charge is heated up to its maximum temperature in about four days. (Br. Pat. 180,689; not yet accepted; Wessels & Wilhelmi, Hamburg, July 26, 1922.)

Hydrocarbons — Low-boiling hydrocarbons are produced by heating mineral oils, tar oils or other hydrocarbons under pressure in presence of hydrogen and a metal or alloy which melts at the reaction temperature. Soldering metals and bismuth alloys melting below 700 deg. C. are specified. (Br. Pat. 180,625; not yet accepted. M. Melamid, Freiburg. July 19, 1922.)

Inhibiting Oxidation—The oxidation of substances by the air—for instance, oils, essences, resins, animal tissues, latexes and rubber—is prevented or inhibited by the addition of a small proportion of a phenolic body, added in the form of solid, solution or vapor. According to the examples, styrolene, furfurol and acetaldehyde are stabilized by the addition of a solution of pyrogallol or guaiacol. The addition of hydroquinone to vegetable oils, such as linseed oil or nut oil, prevents their turning rancid. (Br. Pat. 181,365, not yet accepted. C. Moureu and C. Dufraisse, Paris. Aug. 2, 1922.)

Technical News of the Week

Current Events in the Chemical, Metallurgical and Allied Industrial Fields
Legislative Developments—Activities of Government Bureaus, Technical Societies and Trade Associations

Dye Embargo and Potash Rates Stumbling Blocks in Final Tariff Debate

Bill Passes House After Conferees, as Instructed, Reverse Their First Action—Dye Embargo Killed and Potash Put on Free List

THE House of Representatives adopted the conference report on the Fordney-McCumber tariff bill on Friday, Sept. 15, after refusing to recommit the report with instructions to reduce the rate on sugar. The report came back to the House shorn of the dye embargo and potash tariff provisions, and an agreement was speedily reached to limit the general discussion on the report to one hour, divided equally between the Republicans and the Democrats.

Dye Rates

Chairman Fordney of the committee explained the action taken by the conferees to bring the report into conformity with the demands of the House. Intermediate coal-tar products were subjected to an ad valorem of 55 per cent and finished products to an ad valorem of 60 per cent, with an additional specific of 7c. per pound in each case. These rates are to remain in operation for two years, when each of the ad valorems will be reduced by 15 per cent. He was assisted by Representative Longworth, Republican, of Ohio, at whose insistence the dye embargo provisions were originally written into the bill.

Longworth Disappointed

"I do not deny that I was very greatly, even bitterly, disappointed at the result on Wednesday on the motion of the gentleman from Texas," said Mr. Longworth. "I am perfectly convinced that the restoration of potash to the free list means the absolute destruction of the industry in this country.

"I was even more bitterly disappointed at the action of the House in striking out the so-called dye embargo. That was not an embargo, for all the dyes that were necessary for any of the consumers of dyes in this country, which were not produced here and were not sold at a satisfactory price, could be imported in any quantity. Under this so-called embargo about 3,000 different dyes have been imported into this country within the last 6 months. They have been coming in ever since we have had this system and would have continued to do so if the system had been made permanent."

Numerous changes were made in the chemical schedule by the conference committee. As a general proposition, the Senate amendments to the chemical schedule were accepted. The bill as a whole is a Senate tariff. Of the 2,436 amendments, important and unimportant, which confronted the conferees, the Senate conferees receded from 71, 303 were compromised, and the House conferees agreed to 2,062 Senate changes.

Organic Acids

The conferees fixed a rate of 17c. per pound on citric acid, the House rate having been 12c. and the Senate rate 18c. Senate action in placing white arsenic on the free list was approved. The conferees struck out the Senate's rate of 4c. per pound on formic acid, with the effect of placing it in the basket clause at 25 per cent ad valorem, which was the House duty.

Alcohol

Senate action in making a rate of 3c. per pound on propyl alcohol was disagreed to and the House rate of 6c. was restored. The House rate of 6c. per pound on fusel oil was restored, in place of the Senate rate of 2c. A compromise rate of 12c. per gallon on methyl or wood alcohol was reached. The House rate of 15c. per gallon was restored on ethyl alcohol for non-beverage purposes.

Barium Salts

House rates on barium compounds were made lower than the Senate rates. These rates are 1c. per pound on carbonate precipitate; 1¼c. per pound on chloride; 4c. per pound on dioxide; 1¼c. per pound on hydroxide and 2c. per pound on barium nitrate. Comparative rates in the Underwood law were from one-fourth of a cent per pound to 15 per cent ad valorem. The duty in the Payne-Aldrich bill was 25 per cent ad valorem.

Camphor

The conferees did not change the rate of 1c. per pound on crude natural camphor and 6c. per pound on refined or synthetic camphor, but they eliminated the Senate amendment which would have imposed a duty of 25 per cent ad valorem whenever it could be shown to the satisfaction of the President that the production of synthetic camphor in the United States reaches

(Continued on page 616)

New Efforts Made for Dye Embargo

House Is Asked to Bar Imports for Three Months After Tariff Goes Into Effect

Although the provision inserted in the conference report on the tariff for another year's dye embargo, and possibly two, was denounced by the House, and overwhelmingly rejected last week, a new embargo plan appeared in Congress on Saturday, Sept. 16, to overcome the tariff agreement before it has been accepted by the Senate.

Representative Tilson of Connecticut introduced a joint resolution to extend the embargo 3 months. Senator Wadsworth of New York is sponsor for the resolution in the Senate. The House resolution reads:

> The dye and chemical control act of 1921, as extended, shall continue in full force and effect for 3 months after the date on which the tariff act of 1922 becomes effective, any provision in such act notwithstanding.

To Meet Administrative Difficulties

It is said that the agreement for an American valuation on dye duties is cumbersome and cannot be used by the customs officials at once, hence it is sought to have the embargo extended 3 months after the tariff goes into effect. This contention, placed before the Finance Committee by Treasure officials, is backed up by a letter from Secretary Mellon.

Secretary Mellon, in his letter written to Senator McLean of Connecticut, calls attention to the difficulties the customs officials will have in determining the American values, and says they should not be called upon to administer the American valuation system as to dyes immediately. He suggests, it is said, that some time be allowed for these officers to work out the American values on the different dyes.

King Will Not Oppose

Those favoring the extension of the embargo 3 months approached Senator King of Utah, a severe anti-embargo Senator, and asked him whether he would continue his opposition to the embargo as proposed in the joint resolution. His reply was that he was not disposed to do so if assured that the request was actually based upon administrative difficulties and was not the forerunner of another move for a further extension when the 3 months' period expired. It is said that the dye interests would not give Senator King a definite promise that they would not seek another extension.

Eight-Hour Shift Recommended

Federated American Engineering Societies' Committee Reports 25 Per Cent Production Increase by Change From Twelve- to Eight-Hour Day

"THE tendency throughout the world is toward the abolition of the 12-hour shift," it is held by the report of the committee on work-periods of the American Engineering Council of the Federated American Engineering Societies, which was adopted after a long discussion by the executive board of the Council in Boston, Friday, Sept. 8. The report, in effect, finds that the two-shift day of 12 hours each is not an economic necessity in American industry.

"In almost every continuous industry," says the report, "there are plants which are operating on an 8-hour shift basis in competition with 12-hour shift plants." It is also shown that in practically every major continuous industry plants which have changed from 12 hours to 8 hours have increased the quantity of production per man up to as much as 25 per cent. In a few cases, the report states, the increase has been much higher. In the steel and iron industry, which is made the subject of a special report, it was found that "the change from the 12- to the 8-hour day has obtained results sufficient to compensate in whole or in part for the extra cost."

Advantages of 8-Hour Day

Other advantages of the 8-hour day in the steel and iron industry are described as increased efficiency, better morale, elimination of the "floating gang," which is maintained to give 12-hour men a day off a week, and greater prestige of the industry with the public.

Prof. Samuel McCune Lindsay of Columbia University, representing the Cabot Fund of Boston, officially styled the report as embodying the results of "the most important investigation of any industrial situation ever undertaken in this country." The Cabot Fund cooperated in the engineering investigation, which occupied nearly 2 years and covered practically every continuous industry in the United States. Professor Lindsay, who is president of the Academy of Political Science, authorized the statement that Prof. Henry R. Seager of Columbia, president of the American Economic Association, shared his general view.

All Major Industries Surveyed

The results of the industrial investigation, which, engineers said, will exercise a great influence on the general labor situation, were obtained through two lines of inquiry. One inquiry, embracing the steel and iron industry of the country, was directed by Bradley Stoughton of New York, former secretary of the American Institute of Mining and Metallurgical Engineers and former adjunct professor of metallurgy in Columbia University.

The second inquiry was directed by Horace B. Drury, industrial investigator and former member of the faculty of Ohio State University. Each inquiry was made the subject of a separate report, the whole investigation being in charge of the Council's committee on work-periods, of which Dr. H. E. Howe of Washington is chairman. Dr. Howe presented the report to the board. His associates on the committee are J. Parke Channing, L. P. Alford, Fred J. Miller and Dwight T. Farnham of New York; Morris L. Cooke of Philadelphia, and L. W. Wallace of Washington.

Presentation of the report by Dr. Howe caused a spirited discussion of 2 hours, during which President Cooley, urging adoption, asserted that the report was a remarkable contribution of the engineering profession toward the advancement of mankind. Others participating in the debate were Philip N. Moore of St. Louis, Prof. Joseph W. Roe of New York University, Irving E. Moulthrop of Boston and W. W. Varney of Cleveland, Calvert Townley of New York, E. S. Carman of Cleveland, John A. Stevens of Lowell, William Rolfe of St. Louis, and Messrs. Channing, Alford and Wallace, representing the committee on work-periods. The report was finally adopted by an overwhelming vote.

Iron and Steel Industry

The Stoughton report, covering iron and steel, asserts that the fact that already many plants operate successfully on the three-shift system indicates that profits need not suffer if the change is made with wisdom. The Stoughton report continues:

"The cost of all labor on either system at the blast furnace is less than $1 per ton of pig. Judge Gary testified before the Lockwood committee in New York in June, 1922, that the U. S. Steel Corporation could produce at $2 per ton less than its competitors. That shows what low overhead and technical skill can accomplish.

"The operating labor in the case of pig iron is from 5.8 to 8 per cent of the total manufacturing cost. Only a part of the labor in the industry is working the 12-hour day. If that labor was changed to the 8-hour day and paid as much per day as it is now getting for 12 hours work, even without securing any compensating advantages through increased efficiency, morale, etc., the total manufacturing cost of the product would be increased only from 3 to 15 per cent.

"This is in most cases less than the variations in cost already experienced by competing plants, due to difference in efficiency of equipment, technical skill, purchasing, location, capital resources, overhead expense and advantages due to good management.

The Stoughton Report

The Stoughton report finds that the 8-hour day makes better men physically and mentally, attracts a better class of men to the industry, improves conduct of operation, makes operation more uniform, betters the quality of product, uses less fuel, involves less waste and less repairs to equipment, and lengthens the life of apparatus. These advantages, the Stoughton report says, are bound up in "increased efficiency manifested in increased production per man per hour and per machine per day."

The 8-hour day, it is declared, produces better morale among workers, resulting in less absence and tardiness, less shirking and better discipline, which results from "better spirit of the men and the greater pressure which foremen can and will exert because they do not have to hold back out of sympathy for tired men."

According to the Stoughton report, which deals with the change from the 12-hour shift to the 8-hour shift in the iron and steel industry, there are altogether about 150,000 wage earners in the entire steel industry on 12-hour shifts.

The report makes recommendations for successful and economic change from the two-shift operation.

Chemical Engineers Dine Under Difficulty

Lack of Food Fails to Dampen Enthusiasm of Social Gathering

About seventy-five members of the American Institute of Chemical Engineers gathered at the Hotel Pennsylvania at dinner on Thursday of exposition week. There was the usual air of genial animation about the festive board and even when the dinner apparently gave out between entrée and dinner course, the diners scarcely noticed it. Finally Dr. Wesson went out and returned with the head waiter's scalp. Then food began to flow again. President Howard announced that at Council meeting it had been decided to hold the fall meeting at Richmond, Va. The membership and cash balances were reported to be in good condition and then Dr. Wesson was asked to tell the members something about Richmond. Tobacco and other large factories in the immediate vicinity, and Hopewell, within a day's excursion, make the prospect promising.

H. C. Parmelee urged the members to take an active interest in the law which has to do with the licensing of engineers. He expressed satisfaction that a committee of the Institute had been authorized to work with the Mining Engineers for the repeal of the law in New York State. J. V. N. Dorr was asked to give some impressions of Europe gathered on his recent trip. The dinner then broke up into groups, but very few broke away to go back to the exposition.

Take Fresh Start on Muscle Shoals

Engineers to Appoint Committee to Make Impartial Survey of Situation

The organized engineers of the country will attempt to solve the problems of Muscle Shoals. Through the executive board of the American Engineering Council at its closing session in Boston, Friday, Sept. 8, the Federated American Engineering Societies adopted a resolution authorizing the appointment of a committee of leading engineers to study thoroughly every phase of the Muscle Shoals problem in order to clear away what was described as "a hopeless muddle" which might lead to grave national disadvantage.

The board was moved to this action by the representatives of the Associated Engineering Societies of St. Louis, William E. Rolfe, city engineer of St. Louis, and Philip N. Moore, chairman of the War Minerals Relief Commission. In a spirited speech supporting the resolution, Mr. Moore denounced the proposal of Henry Ford, citing figures tending to show that acceptance of this proposal by the government would be unwise.

Biggest Volunteer Enterprise

The president of the Federated American Engineering Societies, Dean Mortimer E. Cooley of the University of Michigan, was directed "to appoint a committee of disinterested, distinguished and skillful engineers, to be selected by a special committee of the executive board and approved by the committee on procedure, for the purpose of making a thorough study of the assembled facts regarding the Muscle Shoals proposition, this committee to serve without compensation."

The Muscle Shoals resolution provides that the committee of engineers chosen to make the study "shall submit to the committee on procedure, and subsequently to the executive board, an outline of the scope of the investigation proposed."

The resolution, which gets under way one of the biggest volunteer enterprises ever undertaken by American engineers, declares that the results of this study will constitute "a service of great and possibly determinative value to the nation" in the settlement of the controversy over Muscle Shoals.

Calvert Townley of New York, vice-president of the Westinghouse Electric & Manufacturing Co. and past president of the American Institute of Electrical Engineers, is chairman of the committee on procedure, which will finally approve the personnel of the committee of engineers chosen. Other members of the committee are Dean Dexter S. Kimball of Cornell University, president of the American Society of Mechanical Engineers; J. Parke Channing of New York, mining engineer, prominent in the copper industry; W. E. Rolfe, St. Louis; W. W. Varney, Baltimore; H. E. Howe, Washington. President Cooley stated that concerted effort will be made to place at the disposal of the nation the services of America's best engineers.

This action by the executive board is the outcome of an attempt made 6 months ago by Mr. Moore at a meeting of the board in Chicago to enlist the impartial skill of the engineers in the Muscle Shoals proposition.

The executive board at its final sessions passed upon a great variety of questions of national engineering, social and political importance. In adopting the report of the committee on reforestration, presented by Chairman Charles H. MacDowell of Chicago, the engineers approved plans to extend the co-operation of their profession to the nation-wide movement to save the nation's forests. The engineers will work with the federal and state forestry services, farmers' organizations, the Boy Scouts and other bodies in the reforestration campaign. The aid of Will H. Hays also will be sought in an effort to acquaint the masses of the people with the danger to future generations of denuding the forests.

Favor Registration for Engineers

Gardner S. Williams of Ann Arbor, Mich., and W. B. Powell of Buffalo were appointed to draft a bill calling for the registration of engineers. This bill will incorporate the recommendations of the American Engineering Council's committee on registration of engineers.

In view of the expanding into national activities of the Council, Dr. William McClellan of Philadelphia, past president of the American Institute of Electrical Engineers, was added to the committee on foreign relations. Prof. James R. Withrow of Ohio State University was elected to the committee on membership and representation.

The executive board approved the universal contract form for building construction devised by the Department of Commerce. The board adjourned to meet in Washington on Jan. 4, when the annual meeting of the American Engineering Council also will be held. The members of the board were luncheon guests at the City Club of the Boston section of the Society of Civil Engineers.

Alpha Chi Sigma Entertains Exposition Guests

About fifty members of Alpha Chi Sigma, the professional chemical fraternity, were the guests of their New York brothers at the annual dinner given Sept. 14 in connection with the Eighth National Exposition of the Chemical Industries. Short talks were made by the principal national officers of the fraternity, including Stroud Jordan, of Brooklyn, its president; Arthur L. Davis of Wood River, Ill., secretary and treasurer; and Paul D. V. Manning, editor of the fraternity's monthly publication *The Hexagon*. A feature of the gathering was an account of the founding of the society given by F. J. Petura, general purchasing engineer, Henry L. Doherty Co. of New York.

Equipment Makers Perfect Association

Chemical Equipment Association Elects Officers and Discusses Relation to Exposition

At a meeting held in the Chemists' Club on the evening of Sept. 12, the manufacturers of chemical equipment and accessory plant apparatus formally adopted a constitution and bylaws and elected officers, thereby perfecting an organization that has been in the formative stage for the past year.

The constitution and bylaws were adopted as printed in *Chemical & Metallurgical Engineering*, p. 947, May 17, 1922, with the exception that provision was made for regional vice-presidents and for the separation of the office of secretary-treasurer, the secretary to be employed by the board of directors and to give his entire time to the work of the organization. The officers elected under this plan were: President, Pierce D. Schenck, Duriron Co.; vice-presidents, Walter E. Lummus, Walter E. Lummus Co.; Adolph Coors, Jr., Coors Porcelain Co.; George J. Lehman, Bethlehem Foundry & Machine Co.; treasurer, P. C. Kingsbury, General Ceramics Co.; directors—H. N. Spicer, Dorr Co.; J. I. Lyle, Carrier Engineering Corp.; P. S. Barnes, Pfaudler Co.; Edward C. Alford, T. Shriver & Co.; T. C. Oliver, Chemical Construction Co.; H. H. Alport, E. B. Badger & Sons Co.

It was announced that thirty-two firms have joined the association as active members and that four representatives of the business and technical press have taken associate membership.

A lively discussion was precipitated when the aims and objects of the association were discussed for the enlightenment of some of those present. When these points were cleared up by reference to the objects as stated in the constitution and through speeches of members who have been particularly active in the organization of the association, it developed that there was some misapprehension regarding the relation of the association to the Chemical Exposition. Some of those present expressed the sentiment that the association should take up with the management of the exposition certain questions relating to exhibitors' interests. It was stated emphatically by George Lehman that this had not been considered the primary purpose of the association and that it would not be undertaken except by direction of the members, now that the association is formally organized. Further discussion on the floor brought out the fact that it would be highly inadvisable for the association to engage in a controversial matter, particularly at its inception. This view finally prevailed and resulted in a decision to leave the satisfactory settlement of the relations between exhibitors and the exposition management to some other medium. Plans were immediately made for an active campaign for new members during exposition week.

Regulate Production of Coal, Says Hoover

Secretary of Commerce Addresses Chemical Salesmen's Association at Big Dinner

About 300 members of the Chemical Salesmen's Association and their guests celebrated the first anniversary of the founding of the association at dinner at the Hotel Commodore on Tuesday, Sept. 12. A very jazzy orchestra enlivened the dinner and a great many songs, old and new, were sung with more or less discord but much enthusiasm. The newly elected president of the association, Mr. Boyer, introduced Charles H. Herty, president of the Synthetic Organic Chemical Manufacturers' Association, as toastmaster. Dr. Herty introduced Secretary of Commerce Hoover, who addressed the association on the coal industry.

Mr. Hoover analyzed the troubles now extant in the coal industry and attributed them in part to the overproductive capacity of the industry. The 8,000 and more bituminous mines in this country can produce 50 per cent excess coal over that consumed during any given year. In other words, the industry can produce about 800,000,000 tons of coal, whereas about 500,000,000 tons is all that has ever been produced. This means that the average miner, not including the time he is on strike, is employed only 40 per cent of the time during the year, and this in turn means that the American public pays its miners a living wage for working less than 60 per cent of the time. The big problem of the industry then is to absorb or adjust in some way this overproduction. Secretary Hoover did not anticipate the findings of the commission, but went on to say that the creation of the commission which will be appointed by the President when the bill on this subject has been passed will be the most constructive step toward the solution of this whole situation, a situation which has been becoming more and more aggravated and which during the last 4 or 5 years has reduced 100,000,000 people to a point of industrial collapse for want of a prime necessity. Mr. Hoover's speech was most enthusiastically received by the association.

Banker Optimistic

In introducing S. H. Sisson, vice-president of the Guaranty Trust Co., who was the next speaker, Dr. Herty pointed out that the bankers had been quite cold on the whole toward the chemical industry, but expressed the belief that with legislation in their favor and a substantial business basis established, the bankers would collaborate with the chemists in establishing this vital industry on a firm basis.

Mr. Sisson took occasion to outline the factors which are both favorable and unfavorable in the industrial and economic situation of today. His summary was an optimistic one, since he felt that the normal productive capacity of this country will return and with it the buying power of the consumers. This, he felt, will more than counterbalance the instability of foreign exchange, the political isolation of the United States, the existence of wars, the discord among the allied powers and many other unfavorable factors. It will not be smooth sailing, but a hard and earnest effort in which the salesmen of the country will be a prominent factor in working out the success of the movement.

Tariff Bill in Final Stage

(Continued from page 613)

2,000,000 lb. a year. This amendment, based on production, was proposed to encourage development of the synthetic camphor industry principally by a St. Louis chemical company which embarked on this enterprise during the war and has since met stiff competition from the Japanese camphor monopoly.

Bleaching Powder

A compromise rate of three-tenths of a cent per pound was fixed on bleaching powder, or chlorinated lime. The Underwood rate was one-tenth of a cent, while the Payne-Aldrich rate was one-fifth of a cent. The Senate ad proposed one-fifth of a cent and the House rate was three-fifths.

Vegetable Oils

Rates on vegetable oils were reduced by the conferees below the figures fixed in the Senate. Linseed oil was cut to 3 3/16c. per pound from 3½c., the House rate having been 2½c. Coconut oil was cut from 4c. to 2c. per pound and soya-bean oil from 3c. to 2½c. per pound.

In comparing House and Senate ad valorem rates, or House ad valorems and those which appear in the final form of the bill, it must be recalled that the original House duties were based upon the American selling price, while the Senate ad valorems and those which appear in the new bill as completed were based upon the foreign price.

Personal

Dr. George Barsky, formerly a research assistant of Prof. Ralph H. McKee, department of chemical engineering, Columbia University, has been appointed to a position in the research department of the Abitibi Paper Co., Abitibi, Ont.

E. B. Benger has been appointed as chemical director of the Newburgh plant of E. I. du Pont de Nemours & Co. He was formerly director of the Redpath Laboratory at Parlin, N. J.

C. W. Crowell has recently resigned as chemist for the California-Hawaiian Sugar Refining Co., Crockett, Calif., to become plant superintendent at the works of the Rochester Germicide Co., Rochester, N. Y.

Dr. Ralph T. Goodwin, who took his degree this summer in the department of chemical engineering of Columbia University, has been appointed to a position in the research department of the Standard Oil Co. of New Jersey. Dr. Goodwin will have as his special concern the shale oil interests of that company.

Prof. Henry LeChatelier of Paris, France, has been elected to honorary membership in the American Society for Steel Treating.

E. W. McCullough has resigned as director of the division of mining and metallurgy, Republic Creosoting Co., to accept an appointment as consulting engineer for refuse disposal with the Indianapolis City Sanitary Commission. This work will involve the design and construction of a plant.

Vladimir Tuma, chemical engineer, has accepted a position with the B. F. Goodrich Co., Akron, Ohio, as the director of the technical library.

Obituary

Prof. Alexander Smith, formerly head of the department of chemistry at Columbia University, died at Edinburgh, Scotland, on Sept. 9. He was the son of Alexander W. Smith, a well-known musician of Edinburgh, where he was born on Sept. 11, 1865. He took his Bachelor's degree at the university of that city in 1886, and his Doctorate in Philosophy at Munich in 1889. He returned to the University of Edinburgh immediately, and for a year was assistant in chemistry at that institution, coming to America the following year to become professor at Wabash College, where he remained until 1894. Then he was called to Chicago, where he made a brilliant career, and in 1911 he was called to Columbia to become head of the department. He was a great teacher and the author of text-books that became standard all over the world. Everyone knows his "Introduction to General Inorganic Chemistry," and his "General Chemistry for Colleges" has also been widely studied. Most of his works were translated into German, Russian, Italian and Portuguese, and are also extensively used where these languages are spoken. About 3 years ago while addressing a class he was overtaken by a fainting spell and shortly afterward was operated on for a tumor in his stomach. Following the operation he suffered from such intense depression that he was unable to take up his work, and he was an invalid from that time on. He worked with great intensity and used himself up in the process. We are glad to say that his "Inorganic Chemistry" has lately been thoroughly revised and brought down to date by Prof. James Kendall and others, so that its splendid qualities of order and exposition will not be lost to future students. He leaves a widow, formerly Miss Sarah Bowles of Memphis, Tenn., and two children.

Market Conditions

In Chemical, Metallurgical and Allied Industries

A Survey of the Economic and Commercial Factors That Influence Trade in Chemicals and Related Commodities
Prevailing Prices and Market Letters From Principal Industrial Centers

Sulphuric Acid and Acid Phosphate Used in the Manufacture of Fertilizers

Statistics for Production, Stocks and Sales Reported by 198 Fertilizer Establishments, of Which 69 Manufactured Sulphuric Acid

ESTABLISHMENTS representing practically all of the fertilizer industry, with the exception of the dry mixing plants, have recently effected a co-operative arrangement with the Ceusus Bureau of the Department of Commerce whereby statistics of production and consumption are to be compiled and published twice each year. This marks the first step toward the compilation and distribution of current statistical information for this very important industry.

These data for the first 6 months of the current year are to be found in Tables I and II. From these tabulations it will be noted that the manufacturers of fertilizer producing sulphuric acid and acid phosphate had on hand Jan. 1, 1922, 129,610 net tons of sulphuric acid (basis of 50 deg. Bé.) and during the 6 months ended June 30, 1922, they produced 560,351 tons, consumed in the manufacture of fertilizer 650,189 tons and they had on hand June 30, 108,955 tons. The purchase of sulphuric acid during the 6 months period exceeded the sales by 155,429 tons.

Acid Phosphate Stocks

The same establishments reported that their stocks of acid phosphate on Jan. 1, 1922, amounted to 2,129,339 net tons, containing 32,818,093 units of available phosphoric acid, averaging 15.9 per cent. There was manufactured during the 6 months period 1,198,724 tons, containing 20,104,992 units, averaging 16 8 per cent. During the 6 months there was sold as acid phosphate, in bags and in bulk, 1,053,437 tons, containing 17,533,284 units of available phosphoric acid, averaging 16.8 per cent and there was used in manufactured goods sold 1,031,240 tons, with 15,523,095 units, or 15.1 per cent, making a total of acid phosphates sold as such or in manufactured goods of 2,378,424 tons, with 38,726,884 units of available phosphoric acid.

These data are compiled from reports made from 198 fertilizer establishments, of which 69 manufactured sulphuric acid. The next report will cover the 6 months ending Dec. 31, 1922.

TABLE I—PRODUCTION, SALES AND INVENTORY OF SULPHURIC ACID; (BASIS 50 DEG. BAUMÉ), JAN. 1 TO JUNE 30, 1922

	Net Tons
On hand Jan. 1, 1922	129,610
Manufactured	560,351
Total	689,961
Incoming shipments, on purchases *	245,081
Outgoing shipments, on sales to fertilizer manufacturers*	89,652
Net excess purchases over sales	155,429
Outgoing shipments, on sales for other purposes than making fertilizers	84,544
Used in making fertilizers	650,189
On hand June 30, 1922	108,955

* For the purpose of this compilation, transfers from or to other plants of the same company are reported as purchases or sales, as the case may be.

TABLE II—PRODUCTION, SALES AND INVENTORIES OF ACID PHOSPHATE, JAN. 1 TO JUNE 30, 1922

	Net Tons	Available Phosphoric Acid Total Units*	Per Cent Ave.	Per Cent Range
Inventory Jan. 1, 1922	2,129,339	32,818,093	15.9	.....
In pile as acid phosphate	1,490,332	25,469,294	17.1	15.3–18.0
In base and complete goods	639,007	7,348,799	11.5	6.5–24.0
Purchased	47,047	813,541	17.3	10.0–44.6
Transferred from other plants of same organization	34,554	513,353	14.9	3.1–36.0
Manufactured (made in plant reporting)	1,198,724	20,104,992	16.8	15.0–19.0
Total	3,409,664	54,249,979		
Sold as acid phosphate	1,053,437	17,533,284	16.8	.....
In bags	666,095	10,912,739	15.9	15.0–19.0
In bulk	387,342	6,620,545	17.1	14.4–18.0
Transferred to other plants of same organization	145,232	2,347,736	16.2	8.0–18.2
Inventory June 30, 1922	1,179,755	18,845,864	16.0	.....
In pile as acid phosphate	929,783	15,916,740	17.1	13.6–20.0
In base and complete goods	249,972	2,929,124	11.7	6.0–29.2
Total sales, transfers, and inventory	2,378,424	38,726,884		
Used in manufactured goods sold	1,031,240	15,523,095	15.1	.....

* A unit equals 20 lb. Total units, tons multiplied by per cent.

Exports and Imports of Chemicals

Statistics for July Show Export Trade Continuing on an Even Keel, With an Appreciable Decline in Imports

Exports of chemicals during July continued in approximately the same volume as during June. The total of chemical and allied products exported in July were valued at $8,463,366. The value of the purely chemical exports was $4,378,678. The total which includes the allied products is more than $2,000,000 greater than in July of 1921, whereas the value of chemical exports alone exceed those of July, 1921, by $1,300,000.

The July figures show the value of all exports of fertilizers and fertilizer materials to have been $1,082,850. Pigments, paints and varnishes were exported to the extent of $855,193. The value of explosives exports was $329,031. Exports of sulphate of ammonia increased from $95,633 in July of 1921 to $647,259 in July of 1922. The exports of caustic soda increased from 3,352,295 lb. in July of 1921 to 7,829,303 lb.

Exports of certain other chemicals in July were as follows: benzol, 18,282,045 lb.; acetic acid, 1,179,239 lb.; sulphuric acid, 1,034,756 lb.; boracic acid, 152,104 lb.; aluminum sulphate, 2,482,821 lb.; acetate of lime, 3,115,168 lb.; calcium carbide, 1,546,995 lb.; chloride of lime, 4,805,388 lb.; copper sulphate, 294,639 lb.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	146.67
Last week	146.67
September, 1921	147
September, 1920	267
April, 1918 (high)	286
April, 1921 (low)	140

By rare coincidence this index number has shown no change for the past week. Higher prices for citric acid, barium chloride and salt cake exactly balanced decreases due to lower prices for caustic soda and aniline oil.

Due to the interest in the exports of caustic soda at this time, the July forwardings to the different countries are set forth in detail as follows:

Countries of Destination	Quantity in Lb.	Countries of Destination	Quantity in Lb.
Denmark	100,142	French West Indies	1,120
Finland	33,000	Argentina	295,786
Germany	711,819	Brasil	842,544
Iceland	200	Chile	372,026
Italy	940,225	Colombia	117,443
Netherlands	158,324	Ecuador	13,700
Portugal	22,400	Peru	103,800
Canada	755,103	Uruguay	93,320
Costa Rica	21,204	Venesuela	38,093
Guatamala	6,640	China	407,238
Honduras	22,300	Java	282,990
Nicaragua	24,100	Hongkong	46,200
Mexico	595,726	Japan	345,840
Trinidad	5,963	Persia	8,000
Other British West Indies	45	Philippines	804,825
Cuba	586,531	Australia	43,680
Dominican Republic	6,700	Other Oceania	68
		Brit. So. Africa	3,160

Imports Decline

The imports of chemicals in July declined appreciably. The total value of chemicals on the free list imported in July was $6,021,730, while those on the dutiable list were valued at $3,365,518. This is a decline of $800,000 on the free list chemicals and over $1,000,000 on the dutiable chemicals. The totals in each instance, however, are materially larger than they were in July of 1921.

The imports of gums alone are responsible for a decline of more than $1,000,000. The total imports during July were valued at $1,961,353, whereas in June the value of the gum imports reached the unusual total of $2,994,463. Coal-tar products declined from $1,455,345 in June, 1922, to $809,638 in July. The following chemicals were imported during July in the quantities shown: muriate of ammonia, 813,323 lb.; sulphide of arsenic, 826,871 lb.; calcium salts, 6,746,896 lb.; benzol, 432,683 lb.; creosote oil, 3,898,528 gal.

The New York Market

New York, Sept. 17, 1922.

The domestic consumer has shown a greater buying interest during the past week and several price advances were recorded among leading interests. The approaching enactment of the new tariff has kept sellers somewhat cautious in booking any future business, but has stimulated speculation on the more important items. Importers are turning down shipment orders and are in fear of having a last-minute change in the tariff rate on some commodity already afloat. The present situation, in general, is very unsteady in the face of these adverse circumstances, and real tonnage business was not transacted during the interval. Producers in most instances were accepting orders for limited quantities only and consumers had to be contented with these allotments. The coal strike settlement was considered a distinctly favorable feature and recent rail peace negotiations were also regarded as an incentive to increased business. The last quarter seems to be considerably more active, and leading interests are of the opinion that business conditions will show a tremendous increase over the previous months. Copper carbonate was advanced 1c. per lb. by producers. Bleaching powder is heavily sold up for near future requirements and spot supplies are in a very strong position. Oxalic acid has ruled very steady since recent advances. Nitrite of soda was advanced during the week and considerable speculation has been noticed among prominent jobbers. Imported sulphide of soda was higher on spot, while shipment material was practically unobtainable. Sulphate of ammonia continues exceedingly strong and spot stocks for export are limited. Salt cake was quoted higher and so was red prussiate of potash. Domestic inquiry for caustic soda and soda ash continues heavy and a much larger volume of business was transacted during the past week. Yellow prussiate of soda was not as active as last week, but price changes were only fractional. Citric acid has been another of the features of the week's trading. Spot goods have been completely bought up and prices were materially advanced.

General and Special Chemicals

Acetate of Lime—The general tone is very firm and producers continue to quote $2.35 per 100 lb. The demand is steady and supplies seem to be sufficient to cover only regular orders.

Barium Carbonate and Chloride—Supplies of both products were very scarce on spot and the general condition appears much firmer. Importers of carbonate quote $65 per ton as an inside figure and hold chloride at $93 @$95 per ton.

Bichromate of Soda—Leading sellers were not eager to quote under 7½c. per lb. The demand was somewhat active for domestic consumption. The export market was irregular.

Carbon Bisulphide—Producers report a fair call for moderate quantities, with quotations held around 6¾@7c. per pound.

Carbonate of Copper—Producers advanced quotations to 20c. per lb. as an inside price and 21c. per lb. for smaller quantities. This represents an increase of 1@2c. per lb. over recent figures.

Caustic Soda—Leading interests are quoting export material at $3.55 per 100 lb. Material for domestic requirements is held around $3.75@$4 per 100 lb. Producers report moderate new business for contract at recent levels.

Nitrite of Soda—Both the domestic and imported goods have shown new strength and inside quotations range around 9c. per lb. Recently dealers have become interested and strong speculation has been noticeable.

Prussiate of Soda—Spot goods were somewhat easier during the latter part of the week, although there were no price reductions. Figures ranged around 23½@24c. per lb.

Salt Cake—Leading interests quoted higher prices for spot and shipment goods. The demand has shown a decided improvement and the lowest price heard was around $23 per ton, f.o.b. works.

Sulphide of Soda—Imported goods were advanced on spot, with 4¼c. per lb. the lowest price heard during the latter part of the week. Shipment material was practically sold up. Domestic factors quote fused 60-62 per cent at 4½ @5c. per lb.

Vegetable Oils

Castor Oil—Leading factors continue to quote the U.S.P. grade at 13c. per lb. and commercial at 12½c. The demand was moderate, with producers holding prices quite firm.

Coconut Oil—There were several transactions during the week for carload lots of Ceylon type at 7½c. per lb., nearby delivery. Ceylon type on spot closed around 8¼@8½c. per lb. Cochin type oil held at 8¾@9c. per lb.

Linseed Oil—The general condition of the market was unchanged from previous reports. Trading in prominent quarters showed very little improvement and spot prices ranged around 88c. per gal., in carload quantities. Imported oil sold at 72c. per gal., prompt shipment. Spot imported oil held around 82c. per gal. Interest in foreign goods was lively during the early part of the week, but later lessened appreciably.

The Metal Markets

Copper and zinc were quite active during the week. One of the notable features has been the advance in antimony. The high tariff rates reported by the conferees have also influenced other metals and the situation, in general, has shown a notable tendency toward livelier trading. Quicksilver and antimony have already reflected the tariff in their new prices. The official contract price of the American Smelting & Refining Co. continues at $5.90 New York. Sales have been quite satisfactory during the interval, due to the reluctance of the chief producers to make quotations. Leading copper producers quoted 14c. delivered. Several large tonnage sales were transacted at this level and the majority of sellers were inclined to hold prices firm at this level. An active market has advanced zinc prices. Sales were noted during the week around $6.40 for prompt shipment. A serious shortage is imminent if consumption keeps up at the present rate and production in leading quarters shows no sign of increasing.

Chilean Saltpeter Exports Show Increase for July

Chilean nitrate sales are increasing, according to a report to the Department of Commerce. July exports of nitrates are in excess of those effected during the month of June and the fact that the nitrate association's sales for future delivery subsequent to June 30 now approximate 500,000 tons presages increased exports during the coming months. A rumor is current to the effect that Germany is negotiating for 600,000 tons to supply a shortage resulting from its deficient production of synthetic nitrate.

The Chicago Market

CHICAGO, ILL., Sept. 14, 1922.

The industrial chemical market was steady and strong during the past 2 weeks. Buying interest continued on a good scale accompanied by price advances on several important items. There was a pronounced scarcity of spot supplies on quite a few items and this, coupled with the uncertainties of future deliveries, forced prices upward. A good increase in the volume of orders received was reported by several concerns, with practically no one offering any complaints.

GENERAL CHEMICALS

Caustic soda continued firm, with only moderate supplies available. The solid 76 per cent material was offered in one direction today at $3.25 per 100 lb. and the ground from the same source at $4.25. *Caustic potash* was in moderate demand, with spot goods offered at 6½c. per lb., basis 88-92 per cent. *Soda ash* moved in the regular channels at $2.25 per 100 lb. for material in cooperage.

Potash alums moved in a good volume and prices were steady. The iron-free lump was quoted at 5@5½c. per lb. and the powdered at 5½@6c. *Sal ammoniac* maintained a firm position and spot material was available at 7¾c. per lb. for the white granular. *Barium carbonate* was firm, with only moderate supplies available for immediate delivery at $80 per ton. *Barium chloride* continued firm and was offered at $110 per ton. *Bleach* was quoted higher at $2.35 per 100 lb. ex-warehouse and was reported to be moving very well. *Copperas* was firm and scarce, with small lots of the crystals offered at $1.40@$1.60 per 100 lb. ex-warehouse. *Copper sulphate* was very firm and moderate supplies were available at 6½c. per lb. *Carbon bisulphide* was rather scarce on spot and holders were reluctant to shade 7½c. per lb. *Carbon tetrachloride* was unsteady and supplies could have been purchased at 8½@9c. per lb. *Formaldehyde* was in a very firm position due to the strength of methanol and was quoted higher at 9½c. per lb. for barrels. *Furfural* was unchanged at 35c. per lb. in 1,000-lb. lots. *Glycerine* was very firm and refiners advanced their prices to 17½@18c. per lb. for the c.p. material in drums. *Lead acetate* was unchanged and supplies were offered at 11@12c. per lb. for the white crystals. *Magnesium metal powder* was offered at the lower figure of $1.20 per lb. for 100-lb. lots.

The coal shortage had a strengthening effect on the bichromate market and supplies were reported to be moving well with prices very firm. *Potash bichromate* of standard brand was quoted at 12c. per lb. and the *soda* at 9@9½c. *Potassium carbonate* moved in a fair way and was firm, with the 96-98 per cent material offered at 6c. per lb. *Potassium permanganate* was advanced by the leading dealers to 17@18c. per lb., price according to quantity. *Sodium bicarbonate* moved in a routine way and was firm at 2½c. per lb. *Sodium cyanide* was in fair demand and the imported 128 per cent material sold at 25c. per lb. *Sodium fluoride* was quiet at 10½c. per lb. *Zinc chloride* was available at 6½@7c. per lb. for the granular.

LINSEED OIL AND TURPENTINE

Linseed oil continued to move in a fair volume, but the price was considered high by some of the dealers. The boiled oil was quoted at the close of today's market at $1.07 per gal. in single-bbl. lots with similar quantities of the raw at $1.05. *Turpentine* was in a position similar to linseed oil and was believed to be too high priced. It was quoted today by the leading interests at $1.40 per gal. for single-bbl. lots.

The Iron and Steel Market

PITTSBURGH, Sept. 15, 1922.

Operations at the steel plants continue to increase. More than a score of steel works blast furnaces have resumed operations since the end of August, when the low point fell in pig iron and steel production. There has been very little increase in the supply of Connellsville coke. The chief factor has been heavier deliveries of union-mined coal to byproduct ovens at steel plants.

From the production of the thirty steel companies which make monthly returns to the American Iron and Steel Institute it may be computed that the industry as a whole produced ingots during August at the average rate of 30,000,000 tons a year, and an estimate may be made that the opening rate of the month was about 34,000,000 tons and the closing rate about 26,000,000 tons. The high point of the year was a 37,000,000-ton rate, reached late in June.

There has been a substantial gain in steel production from the low rate of a fortnight ago, but it is doubtful whether the higher rate of last June will be attained in the near future. Railroad congestion is becoming severe and it is possible that the present rate of coal shipping cannot be maintained.

There are more cases of car shortages at steel plants. More than half the plants requiring box cars are short. A practically new development, of the past week, is the placing of embargoes against shipments to various points, consumers thus being shut off from the receipt of steel.

The steel market is now almost entirely one of early deliveries. Jobbers and manufacturing consumers exhibit little interest in late deliveries in December or the first quarter of the new year, and any earlier delivery is more or less a special delivery, involving a premium.

STEEL PRICES

It is understood in the trade that Carnegie prices are still 1.90c. on bars and 2c. on shapes and plates, deliveries being far in the future and by no means guaranteed. The common price among independents is 2.25c. for all three products, but a few are taking orders from regular customers at 2.15c. in the case of bars.

In sheets there are no sellers left on the 3.35c. basis except the Steel Corporation, the two most conservative independents having advanced to a 3.50c. basis. Reports are of sales at 3.75c., but such sales are probably of quite small volume, since at 3.50c. one can obtain delivery in a few weeks.

All the independent wire mills have advanced their prices $3 a ton, to 2.50c. for plain wire and $2.75 for nails. The prices are readily obtained by such mills as can make early deliveries. One mill is able to ship nails in a fortnight.

Under date of Sept. 13 the Reading Iron Co. has advanced wrought iron pipe 5½ points, or about $11 a ton, and it is expected other makers will follow. This is the second advance in a short time. The new basing discount is 34 per cent.

PIG IRON UNCERTAIN

Question is being raised whether pig iron can hold its recently attained levels, and predictions that further advances will occur, to $40 or $50, have become quite unpopular. The demand for foundry iron, which has been quotable at $35@$36, valley basis, on the strength of some resales and some purchases of Buffalo iron, has been decidedly light. In the case of basic iron, the $30 valley price recently quoted as the nominal market is considered rather more than consumers are able to pay. It is stated positively that a steel works did buy 2,000 tons a few days ago at $32.50 valley, the iron coming from a speculative interest that had held it since early in the year, but on the other hand it is related that $30 has been quoted since then without finding any taker.

Production of merchant pig iron is very light and is increasing but little if at all. The blast-furnace resumptions have been almost wholly of steel works stacks, resulting from better coal deliveries to their attendant byproduct ovens. Offerings of Connellsville coke have increased a trifle, but are still very meager, and the chief dependence of merchant furnaces normally is on Connellsville coke or surplus coke from byproduct plants of steel interests. Connellsville furnace coke is quotable at $11@$11.50, but the market is made almost wholly by purchases of water-gas manufacturers, lime burners, brickyards, etc. Foundry coke is $12.50 @$13. For a fortnight car supplies in the Connellsville region have been no more than adequate, and in the past couple of days some really serious shortages have been reported. Nominally, the strike is still on in the region, but practically it is no longer of consequence, as increasing working forces and decreasing transportation facilities have now practically met.

Pittsburgh district steam coal has softened 25c. in the week, being now quotable at $4.25@$4.50. Connellsville steam coal is held at $4.25, but is not in favor in competition with Pittsburgh coal. Byproduct coal is $4.75@$5.

General Chemicals

Current Wholesale Prices in New York Market

		Carlots F.o.b. N.Y.	Less Carlots F.o.b. N.Y.
Acetic anhydride	lb.	..... –	$0.38 – $0.40
Acetone	lb.	$0.13½ – $0.13½	.14 – .14½
Acid, acetic, 28 per cent	100 lbs.	2.70 – 2.80	2.85 – 3.30
Acetic, 56 per cent	100 lbs.	5.35 – 5.40	5.45 – 5.75
Acetic, glacial, 99½ per cent, carboys,	100 lbs.	11.00 – 11.25	11.50 – 12.00
Boric, crystals	lb.	.11 – .11½	.11½ – .12
Boric, powder	lb.	.11 – .11½	.11½ – .12½
Citric	lb.	..... –	.47 – .48
Hydrochloric	100 lb.	1.10 – 1.20	1.25 – 1.70
Hydrofluoric, 52 per cent	lb.	.11 – .11½	.11 – .12
Lactic, 44 per cent tech	lb.	.09½ – .10	.10 – .12
Lactic, 22 per cent tech	lb.	.04 – .04½	.04 – .05
Molybdic, c.p.	lb.	3.00 – 3.25	3.30 – 3.75
Muriatic, 20 deg. (see hydrochloric)	....	..... –	..... – .....
Nitric, 40 deg	lb.	.06 – .06½	.06½ – .07
Nitric, 42 deg	lb.	.06½ – .06½	.07 – .07½
Oxalic, crystals	lb.	.17½ – .17½	.17½ – .18½
Phosphoric, 50 per cent solution	lb.	.08 – .08½	.08½ – .09½
Picric	lb.	.20 – .22	.23 – .27
Pyrogallic, resublimed	lb.	..... –	1.65 – 1.75
Sulphuric, 60 deg., tank cars	ton	10.00 – 10.50	..... – .....
Sulphuric, 60 deg., drums	ton	12.00 – 14.00	..... – .....
Sulphuric, 66 deg., tank cars	ton	15.00 – 16.00	..... – .....
Sulphuric, 66 deg., drums	ton	19.00 – 20.00	20.50 – 21.00
Sulphuric, 66 deg., carboys	ton	..... –	..... – .....
Sulphuric, fuming, 20 per cent (oleum) tank cars	ton	19.00 – 20.00	..... – .....
Sulphuric, fuming, 20 per cent(oleum) drums	ton	22.00 – 22.50	23.00 – 24.00
Sulphuric, fuming, 20 per cent(oleum) carboys	ton	31.00 – 32.00	33.00 – 34.00
Tannic, U. S. P.	lb.	..... –	.60 – .75
Tannic (tech.)	lb.	.40 – .45	.46 – .50
Tartaric, imported crystals	lb.	..... –	.29½ – .30
Tartaric acid, imported, powdered	lb.	..... –	.30 – .31
Tartaric acid, domestic	lb.	..... –	..... – .30
Tungstic, per lb. of WO$_3$	lb.	..... –	1.00 – 1.10
Alcohol, ethyl (Cologne spirit)	gal.	..... –	4.75 – 4.95
Alcohol, methyl (see methanol)	....	..... –	..... – .....
Alcohol, denatured, 188 proof No. 1	gal.	..... –	.34 – .35
Alcohol, denatured, 188 proof No. 5	gal.	..... –	.34 – .35
Alum, ammonia, lump	lb.	.03½ – .03½	.03½ – .04
Alum, potash, lump	lb.	.03 – .03½	.03½ – .04
Alum, chrome lump	lb.	.05 – .05½	.05½ – .06
Aluminum sulphate, commercial	100 lb.	1.50 – 1.65	1.70 – 2.25
Aluminum sulphate, iron free	lb.	.02½ – .02½	.03 – .03½
Aqua ammonia, 26 deg., drums (750 lb.)	lb.	.06½ – .07½	.07½ – .08
Ammonia, anhydrous, cyl. (100-150 lb.)	lb.	.30 – .30½	.30½ – .31
Ammonium carbonate, powder	lb.	.08½ – .08½	.09 – .09½
Ammonium nitrate	lb.	.06 – .06½	.06½ – .07½
Amylacetate tech	gal.	..... –	2.25 – 2.35
Arsenic, white, powdered	lb.	.08½ – .09	.09½ – .09½
Arsenic, red, powdered	lb.	.12 – .12½	.12½ – .13
Barium carbonate	ton	65.00 – 67.00	68.00 – 70.00
Barium chloride	ton	93.00 – 95.00	96.00 – 100.00
Barium dioxide (peroxide)	lb.	.20 – .21	.21½ – .22
Barium nitrate	lb.	.07½ – .07½	.08 – .08½
Barium sulphate (precip.) (blanc fixe)	lb.	.04 – .04½	.04½ – .04½
Blanc fixe, dry	lb.	.04 – .04½	..... – .....
Blanc fixe, pulp	ton	45.00 – 55.00	..... – .....
Bleaching powder	100 lb.	2.00 – 2.10	2.15 – 3.25
Blue vitriol (see copper sulphate)	.....	..... –	..... – .....
Borax	lb.	.05½ – .05½	.06 – .06½
Brimstone (see sulphur, roll)	.....	..... –	..... – .....
Bromine	lb.	.27 – .28	.28½ – .35
Calcium acetate	100 lbs.	2.35 – 2.40	2.45 – 2.50
Calcium carbide	lb.	.04½ – .04½	.05 – .05½
Calcium chloride, fused, lump	ton	22.00 – 23.00	23.50 – 27.00
Calcium chloride, granulated	lb.	.01½ – .01½	.02 – .02½
Calcium peroxide	lb.	..... –	1.40 – 1.50
Calcium phosphate, tribasic	lb.	..... –	.15 – .16
Camphor	lb.	..... –	.83 – .85
Carbon bisulphide	lb.	.06½ – .07	.07½ – .07½
Carbon tetrachloride, drums	lb.	.09½ – .10	.10½ – .12
Carbonyl chloride, (phosgene)	lb.	..... –	.60 – .75
Caustic potash (see potassium hydroxide)	.....	..... –	..... – .....
Caustic soda (see sodium hydroxide)	.....	..... –	..... – .....
Chalk, precip.—domestic, light	lb.	.04½ – .04½	..... – .....
Chalk, precip.—domestic, heavy	lb.	.03½ – .03½	..... – .....
Chalk, precip.—imported, light	lb.	.04½ – .05	..... – .....
Chlorine, gas, liquid-cylinders (100 lb.)	lb.	.05 – .05½	.05½ – .06
Chloroform	lb.	..... –	.25 – .32
Cobalt oxide	lb.	..... –	2.00 – 2.10
Copperas	ton	20.00 – 22.00	23.00 – 30.00
Copper carbonate, green precipitate	lb.	.20 – .20½	.20½ – .21
Copper cyanide	lb.	..... –	.58 – .60
Copper sulphate, crystals	100 lb.	6.25 – 6.50	6.60 – 6.75
Cream of tartar	lb.	..... –	.23 – .25
Epsom salt (see magnesium sulphate)	.....	..... –	..... – .....
Ethyl acetate com. 85%	gal.	..... –	.65 – .70
Ethyl acetate, pure (acetic ether, 98% to 100%)	gal.	..... –	.90 – .95
Formaldehyde, 40 per cent	lb.	.09 – .09½	.09½ – .10
Fullers earth, f.o.b. mines	net ton	16.00 – 17.00	..... – .....
Fullers earth—imported powdered—net	ton	30.00 – 32.00	..... – .....
Fusel oil, ref	gal.	..... –	2.75 – 2.90
Fusel oil, crude	gal.	..... –	1.55 – 1.75
Glauber's salt (see sodium sulphate)	.....	..... –	..... – .....
Glycerine, c. p. drums extra	lb.	..... –	.17 – .17½
Iodine, resublimed	lb.	..... –	4.40 – 4.50
Iron oxide, red	lb.	..... –	.12 – .18
Lead acetate, white crystals	lb.	..... –	.10½ – .11½
Lead arsenate, powd	lb.	.13 – .13½	.13½ – .14½
Lead nitrate	lb.	..... –	.15 – .20
Litharge	lb.	.07½ – .08	.08 – .09
Magnesium carbonate, technical	lb.	.06 – .06½	.06½ – .07½
Magnesium sulphate, U. S. P.	100 lb.	2.00 – 2.25	2.30 – 2.50
Magnesium sulphate, technical	100 lb.	..... –	1.60 – 1.80
Methanol, 95%	gal.	..... –	.57 – .58
Methanol, 97%	gal.	..... –	.59 – .60
Nickel salt, double	lb.	..... –	.11 – .11½
Nickel salt, single	lb.	..... –	.12 – .12½
Phosgene (see carbonyl chloride)	.....	..... –	..... – .....
Phosphorus, red	lb.	..... –	.40 – .45
Phosphorus, yellow	lb.	..... –	.30 – .35
Potassium bichromate	lb.	.10½ – .10½	.11 – .11½
Potassium bromide, granular	lb.	..... –	.17 – .23
Potassium carbonate, U. S. P.	lb.	.12 – .12½	.13 – .16
Potassium carbonate, 80–85%	lb.	.05 – .05½	.05½ – .06
Potassium chlorate, powdered and crystals	lb.	.06½ – .07	.07½ – .08
Potassium cyanide	lb.	..... –	.55 – .57
Potassium hydroxide (caustic potash)	100 lb.	5.50 – 5.75	6.00 – 6.25
Potassium iodide	lb.	..... –	3.45 – 3.55
Potassium nitrate	lb.	.06½ – .06½	.07 – .08
Potassium permanganate	lb.	.14½ – .15	.15½ – .16
Potassium prussiate, red	lb.	..... –	.95 – 1.00
Potassium prussiate, yellow	lb.	.35½ – .35½	.36 – .36½
Rochelle salts (see sodium potas. tartrate)	....	..... –	..... – .....
Salammoniac, white, granular	lb.	.06 – .06½	.06½ – .07
Salammoniac, gray, granular	lb.	.07½ – .08	.08½ – .08½
Salsoda	100 lb.	1.20 – 1.40	1.45 – 1.60
Salt cake (bulk)	ton	25.00 – 27.00	..... – .....
Soda ash, light, 58 per cent flat, bags, contract	100 lb.	1.60 – 1.67	2.00 – 2.25
Soda ash, light, 58 per cent flat, bags, resale	100 lb.	1.75 – 1.80	1.85 – 2.35
Soda ash, dense, in bags, resale	100 lb.	1.85 – 1.90	1.95 – 2.40
Sodium acetate	lb.	.07½ – .07½	.07½ – .08
Sodium bicarbonate	100 lb.	1.75 – 1.85	1.90 – 2.30
Sodium bichromate	lb.	.07½ – .07½	.08 – .08½
Sodium bisulphate (nitre cake)	ton	4.50 – 4.60	4.65 – 5.50
Sodium bisulphite powdered, U.S.P.	lb.	.04½ – .04½	.04½ – .05½
Sodium chlorate	lb.	.06½ – .06½	.07 – .07½
Sodium chloride	long ton	12.00 – 13.00	..... – .....
Sodium cyanide	lb.	.19½ – .21	.21½ – .25
Sodium fluoride	lb.	.09 – .09½	.09½ – .10
Sodium hydroxide (caustic soda) solid, 76 per cent flat, drums, contract	100 lb.	3.35 – 3.40	3.75 – 4.00
Sodium hydroxide (caustic soda) solid, 76% flat, drums, resale	100 lb.	3.60 – 3.65	3.70 – 4.00
Sodium hydroxide (caustic soda), ground and flake, contracts	100 lb.	3.80 – 3.90	4.25 – 4.40
Sodium hydroxide (caustic soda) ground and flake, resale	100 lb.	4.00 – 4.15	4.40 – 4.60
Sodium hyposulphite	lb.	.02½ – .03	.03½ – .03½
Sodium nitrite	lb.	.09 – .09½	.09½ – .09½
Sodium peroxide, powdered	lb.	.28 – .30	.31 – .35
Sodium phosphate, dibasic	lb.	.03½ – .04	.04½ – .04½
Sodium potassium tartrate (Rochelle salts)	lb.	..... –	.18 – .21
Sodium prussiate, yellow	lb.	.23½ – .23½	.24 – .24½
Sodium silicate, (40 deg. in drums)	100 lb.	.80 – 1.00	1.05 – 1.25
Sodium silicate, (60 deg. in drums)	100 lb.	2.25 – 2.40	2.45 – 2.75
Sodium sulphate, crystals (glaubers salt)	100 lbs.	.85 – .95	1.00 – 1.40
Sodium sulphide, fused, 60-62 per cent (cone.)	lb.	.04½ – .04½	.04½ – .05
Sodium sulphite, crystals	lb.	.03½ – .03½	.03½ – .04½
Strontium nitrate, powdered	lb.	.09½ – .10	.10½ – .12
Sulphur chloride, yellow	lb.	.04½ – .05	.05½ – .06
Sulphur, crude	ton	18.00 – 20.00	..... – .....
Sulphur dioxide, liquid, cylinders extra	lb.	.08 – .08½	.09 – .10
Sulphur (sublimed), flour	100 lb.	..... –	2.25 – 3.10
Sulphur, roll (brimstone)	100 lb.	2.00 – 2.15	2.20 – 2.70
Talc—imported	ton	30.00 – 40.00	..... – .....
Talc—domestic powdered	ton	18.00 – 25.00	..... – .....
Tin bichloride	lb.	.09 – .09½	.09½ – .10
Tin oxide	lb.	..... –	.35 – .37
Zinc carbonate	lb.	.14 – .14½	.14½ – .15½
Zinc chloride, gran.	lb.	.5½ – .06	.06½ – .06½
Zinc cyanide	lb.	.42 – .44	.45 – .47
Zinc oxide, XX	lb.	.07½ – .08	.08½ – .08½
Zinc sulphate	100 lb.	2.75 – 3.00	3.05 – 3.30

Coal-Tar Products

NOTE—These prices are for original packages in large quantities f.o.b. N.Y.:

Alpha-naphthol, crude	lb.	$0.95 — $1.00
Alpha naphthol, refined	lb.	1.10 — 1.15
Alpha-naphthylamine	lb.	.28 — .30
Aniline oil, drums extra	lb.	.15 — .17
Aniline salts	lb.	.20 — .22
Anthracene, 80% in drums (100 lb.)	lb.	.75 — 1.00
Benzaldehyde U.S.P.	lb.	1.35 — 1.50
Benzene, pure, water-white, in drums (100 gal.)	gal.	.30 — .35
Benzene, 90%, in drums (100 gal.)	gal.	.28 — .32
Benzidine, base	lb.	.85 — .95
Benzidine sulphate	lb	.80 — .85
Benzoic acid, U.S.P.	lb.	.70 — .75
Benzoate of soda, U.S.P.	lb.	.53 — .55
Benzyl chloride, 95-97%, refined	lb.	.25 — .27
Benzyl chloride, tech	lb.	.20 — .23
Beta-naphthol benzoate	lb.	3.75 — 4.00
Beta-naphthol, sublimed	lb.	.50 — .55
Beta-naphthol, tech	lb.	.23 — .25
Beta-naphthyla mine, sublimed	lb.	1.50 — 1.60
Carbazol	lb.	.75 — .90
Cresol, U. S. P., in drums (100 lb.)	lb.	.12 — .15
Ortho-cresol, in drums (103 lb.)	lb.	.16 — .18
Cresylic acid, 97–99%, straw color, in drums	gal.	.56 — .65
Cresylic acid, 95-97%, dark, in drums	gal.	.51 — .58
Dichlorbenzene	lb.	.06 — .09
Diethylaniline	lb.	.55 — .60
Dimethylaniline	lb.	.32 — .34
Dinitrobenzene	lb.	.20 — .22
Dinitroclorbenzene	lb.	.21 — .22
Dinitronaphthalene	lb.	.30 — .32
Dinitrophenol	lb.	.32 — .34
Dinitrotoluene	lb.	.22 — .24
Dip oil, 25%, car lots, in drums	gal.	.24 — .26
Diphenylamine	lb.	.54 — .56
H-acid	lb.	.75 — .80
Meta-phenylenediamine	lb.	.90 — 1.00
Monochlorbenzene	lb.	.10 — .11
Monoethylaniline	lb.	.95 — 1.10
Naphthalene crushed, in bbls.	lb.	.06 — .06½
Naphthalene, flake	lb.	.06½ — .07
Naphthalene, balls	lb.	.07½ — .08
Naphthionate of soda	lb.	.58 — .65
Naphthionic acid, crude	lb.	.65 — .70
Nitrobenzene	lb.	.10 — .12
Nitro-naphthalene	lb.	.30 — .35

Nitro-toluene	lb.	$0.15 —	$0.10
N-W acid	lb.	1.15 —	1.30
Ortho-amidophenol	lb.	2.10 —	2.15
Ortho-dichlor-benzene	lb.	.17 —	.20
Ortho-nitro-phenol	lb.	.75 —	.77
Ortho-nitro-toluene	lb.	.10 —	.13
Ortho-toluidine	lb.	.12 —	.14
Para-amidophenol, base	lb.	1.20 —	1.25
Para-amidophenol, HCl	lb.	1.25 —	1.30
Para-dichlorbenzene	lb.	.17 —	.20
Paranitroaniline	lb.	.72 —	.80
Para-nitrotoluene	lb.	.55 —	.65
Para-phenylenediamine	lb.	1.55 —	1.60
Para-toluidine	lb.	.85 —	.90
Pthalic anhydride	lb.	.35 —	.38
Phenol, U. S. P., drums	lb.	.21 —	.22
Pyridine	gal.	1.75 —	2.75
Resorcinol, technical	lb.	1.50 —	1.55
Resorcinol, pure	lb.	2.00 —	2.10
R-salt	lb.	.55 —	.60
Salicylic acid, tech., in bbls	lb.	.25 —	.27
Salicylic acid, U. S. P	lb.	.29 —	.30
Solvent naphtha, water-white, in drums, 100 gal	gal.	.27 —	.32
Solvent naphtha, crude, heavy, in drums, 100 gal	gal.	.12 —	.14
Sulphanilic acid, crude	lb.	.24 —	.26
Tolidine	lb.	1.20 —	1.30
Toluidine, mixed	lb.	.30 —	.35
Toluene, in tank cars	gal.	.25 —	.28
Toluene, in drums	gal.	.30 —	.35
Xylidines, drums, 100 gal	lb.	.40 —	.45
Xylene, pure, in drums	gal.	.40 —	.45
Xylene, pure, in tank cars	gal.	.45 —	....
Xylene, commercial, in drums, 100 gal	gal.	.33 —	.35
Xylene, commercial, in tank cars	gal.	.30 —	....

Waxes

Prices based on original packages in large quantities f.o.b. N.Y.

Bayberry Wax	lb.	$0.19½ —	$0.20
Beeswax, refined, dark	lb.	.30 —	.32
Beeswax, refined, light	lb.	.34 —	.35
Beeswax, pure white	lb.	.38 —	.42
Candellila, wax	lb.	.38 —	.40
Carnauba, No. 1	lb.	.40 —	.42
Carnauba No. 2, North Country	lb.	.25 —	.26
Carnauba, No. 3, North Country	lb.	.19 —	.19½
Japan	lb.	.15½ —	.16
Montan, crude	lb.	.03½ —	.04
Paraffine waxes, crude match wax (white) 105-110 m.p.	lb.	.04½ —	....
Paraffine waxes, crude, scale 124-126 m.p.	lb.	.02½ —	....
Paraffine waxes, refined, 118-120 m.p.	lb.	.03½ —	.03½
Paraffine waxes, refined, 125 m.p.	lb.	.03½ —	.03½
Paraffine waxes, refined, 128-130 m.p.	lb.	.04 —	.04½
Paraffine waxes, refined, 133-135 m.p.	lb.	.04½ —	.04½
Paraffine waxes, refined, 135-137 m.p.	lb.	.05 —	.05½
Stearic acid, single pressed	lb.	.09 —	.09½
Stearic acid, double pressed	lb.	.09½ —	.09½
Stearic acid, triple pressed	lb.	.10½ —	.10½

Naval Stores

All prices are f.o.b. New York unless otherwise stated, and are based on carload lots. The oils in 50-gal. bbls., gross weight, 500 lb.

Rosin B-D, bbl	280 lb.	$6.25 —	$6.30
Rosin E-I	280 lb.	6.35 —	6.40
Rosin K-N	280 lb.	6.45 —	6.65
Rosin W. G.-W. W	280 lb.	7.85 —	8.40
Wood rosin, bbl	280 lb.	6.25 —	....
Spirits of turpentine	gal.	1.23 —	1.24
Wood turpentine, steam dist	gal.	1.15 —	....
Wood turpentine, dest. dist	gal.	1.12 —	.70
Pine tar pitch, bbl	200 lb.	..... —	6.00
Tar, kiln burned, bbl. (500 lb.)	bbl.	..... —	9.50
Retort tar, bbl	500 lb.	—	9.00
Rosin oil, first run	gal.	.38 —	.....
Rosin oil, second run	gal.	.41 —	.....
Rosin oil, third run	gal.	.48 —	.....
Pine oil, steam dist., sp.gr., 0.930-0.940	gal.		1.00
Pine oil, pure, dest. dist	gal.		.95
Pine tar oil, ref., sp.gr. 1.025-1.035	gal.		.46
Pine tar oil, crude, sp.gr. 1.025-1.035 tank cars f.o.b. Jacksonville, Fla	gal.		.35
Pine tar oil, double ref., sp.gr. 0.965-0.990	gal.		.75
Pine tar, ref., thin, sp.gr., 1.080-1.960	gal.		.25
Hardwood oil, f.o.b. Mich., sp.gr., 0.960-0.990	gal.		.25
Pinewood creosote, ref	gal.		.52

Fertilizers

Quotations same as previous report.

Crude Rubber

Para—Upriver fine	lb.	$0.18½ —	.18½
Upriver coarse	lb.	.13½ —	.14
Upriver caucho ball	lb.	.13 —	.13½
Plantation—First latex crepe	lb.	.14½ —	.14½
Ribbed smoked sheets	lb.	.14½ —	.14½
Brown crepe, thin, clean	lb.	.13½ —	....
Amber crepe No. 1	lb.	.14 —	....

Oils

VEGETABLE

The following prices are f.o.b. New York for carload lots.

Castor oil, No. 3, in bbls	lb.	$0.12½ —	$0.13
Castor oil, AA, in bbls	lb.	.13 —	.13½
China wood oil, in bbls	lb.	.12½ —	.12½
Coconut oil, Ceylon grade, in bbls	lb.	.08½ —	.08½
Coconut oil, Cochin grade, in bbls	lb.	.08½ —	.09
Corn oil, crude, in bbls	lb.	.10½ —	.10½
Cottonseed oil, crude (f. o. b. mill)	lb.	.06½ —	.07
Cottonseed oil, summer yellow	lb.	.09 —	.09½
Cottonseed oil, winter yellow	lb.	.10 —	.10½
Linseed oil, raw, car lots (domestic)	gal.	.88 —	.88½
Linseed oil, raw, tank cars (domestic)	gal.	.83 —	.84
Linseed oil, boiled, in 5-bbl lots (domestic)	gal.	.90 —	.91
Olive oil, denatured	gal.	1.15 —	1.17
Palm, Lagos	lb.	.06½ —	.07
Palm, Niger	lb.	.06 —	.06½
Peanut oil, crude, tank cars (f.o.b. mill)	lb.	.08½ —	.08½
Peanut oil, refined, in bbls	lb.	.12 —	.12½
Rapeseed oil, refined in bbls	gal.	.79 —	.80
Rapeseed oil, blown, in bbls	gal.	.86 —	.87
Soya bean oil (Manchurian), in bbls N. Y.	lb.	.11½ —	....
Soya bean oil, tank cars, f.o.b., Pacific coast	lb.	.09½ —	....

FISH

Light pressed menhaden	gal.	$0.53 —	....
Yellow bleached menhaden	gal.	.54 —	.55
White bleached menhaden	gal.	.56 —	.57
Blown menhaden	gal.	.61 —	....
Whale Oil, No. 1, crude, tanks, coast	gal.	.45 —	.48

Miscellaneous Materials

All f.o.b. New York, Unless Otherwise Stated

Asbestos, crude No. 1, f.o.b., Quebec, Canada	short ton	$700.00 —	$750.00
Asbestos, shingle stock, f.o.b., Quebec, Canada	short ton	65.00 —	100.00
Asbestos, cement stock, f.o.b., Quebec, Canada	short ton	14.00 —	17.00
Barytes, ground, white, f.o.b. mills	net ton	17.00 —	23.00
Barytes, ground, off color f.o.b. mills	net ton	13.00 —	21.00
Barytes, floated, f.o.b. St. Louis	net ton	23.00 —	24.00
Barytes, crude f.o.b. mines	net ton	8.00 —	9.00
Casein	lb.	.10½ —	.13
China clay (kaolin) crude, f.o.b. mines, Georgia	net ton	6.00 —	8.00
China clay (kaolin) washed, f.o.b. Georgia	net ton	8.00 —	9.00
China clay (kaolin) powdered, f.o.b. Georgia	net ton	12.00 —	20.00
China clay (kaolin) crude f.o.b. Virginia points	net ton	8.00 —	12.00
China clay (kaolin) ground, f.o.b. Virginia points	net ton	13.00 —	20.00
China clay (kaolin), imported, lump	net ton	16.00 —	20.00
China clay (kaolin), imported, powdered	net ton	30.00 —	35.00
Feldspar, No. 1 pottery grade	long ton	7.00 —	7.50
Feldspar, No. 2 pottery grade	long ton	5.75 —	5.90
Feldspar, No. 1 soap grade	long ton	7.00 —	7.50
Feldspar, No. 1 Canadian, for mill	long ton	21.00 —	22.00
Graphite, Ceylon lump, first quality, f.o.b. N. Y.	lb.	.05 —	.05½
Graphite, Ceylon chip	lb.	.04 —	.04½
Graphite, high grade amorphous crude	ton	35.00 —	50.00
Kieselguhr, f.o.b. mines, Cal	per ton	40.00 —	....
Kieselguhr, f.o.b. N. Y	per ton	50.00 —	55.00
Magnesite, crude, f.o.b. California mines	per ton	12.00 —	15.00
Pumice stone, imported	lb.	.03 —	.05
Pumice stone, domestic, lump	lb.	.05 —	.05½
Pumice stone, domestic, ground	lb.	.06 —	.07
Shellac, orange fine	lb.	.70 —	.71
Shellac, orange superfine	lb.	.72 —	.73
Shellac, A. C. garnet	lb.	.70 —	.71
Shellac, T. N	lb.	.68 —	.69
Silica, glass sand, f.o.b. Indiana	per ton	1.50 —	2.50
Silica, sand blast material, f.o.b. Indiana	per ton	2.50 —	5.00
Silica, amorphous, 250 mesh, f.o.b. Illinois	per ton	16.00 —	16.00
Silica, building sand, f.o.b. Pa	per ton	2.00 —	2.75
Soapstone	ton	12.00 —	15.00
Talc, 200 mesh, f.o.b. Vermont	ton	7.00 —	12.00
Talc, 200 mesh, f.o.b. Georgia	ton	7.50 —	12.00
Talc, 200 mesh, f.o.b. Los Angeles	ton	15.00 —	17.00

Refractories

Prices remain unchanged.

Ferro-Alloys

Ferrotitanium, 15-18%, f.o.b. Niagara Falls, N. Y	net ton	$200.00 —	$225.00
Ferrochromium, per lb. of Cr contained, 6-8% carbon, carlots	lb.	.10 —	10½
Ferrochromium, per lb. of Cr contained, 4-6% carbon, carlots	lb.	.10½ —	.11
Ferromanganese, 78-82% Mn, domestic	gross ton	67.50 —	72.00
Spiegeleisen, 19-21% Mn	gross ton	36.00 —	....
Ferromolybdenum, 50-60% Mo, per lb. of Mo	lb.	1.85 —	2.00
Ferrosilicon, 10-15%	gross ton	38.00 —	40.00
Ferrosilicon, 50%	gross ton	58.00 —	60.00
Ferrosilicon 75%	gross ton	115.00 —	120.00
Ferrotungsten, 70-80%, per lb. of contained W	lb.	.42½ —	.45
Ferro-uranium, 35-50% of U, per lb. of U content	lb.	6.00 —	.....
Ferrovanadium, 30-40% per lb. of contained V	lb.	3.50 —	4.00

Ores and Semi-finished Products

Prices remain quotably unchanged.

Non-Ferrous Metals

All f.o.b. New York Unless Otherwise Stated

	Cents per Lb.
Copper, electrolytic	14.00
Aluminum, 98 to 99 per cent	18.00-18.50
Antimony, wholesale lots, Chinese and Japanese	6.00-6.50
Nickel, ordinary (ingot)	36.00
Nickel, electrolytic	39.00
Nickel, electrolytic, resale	32.00-33.00
Nickel, ingot and shot, resale	30.00-31.00
Monel metal, shot and blocks	32.00
Monel metal, ingots	35.00
Monel metal, sheet bars	38.00
Tin, 5-ton lots, Straits	32.25
Lead, New York, spot	5.90
Lead, E. St. Louis, spot	5.625
Zinc, spot, New York	6.70-6.75
Zinc, spot, E. St. Louis	6.35-6.40

OTHER METALS

Silver (commercial)	oz.	$0.69½
Cadmium	lb.	1.20-1.25
Bismuth (500 lb. lots)	lb.	2.00@2.10
Cobalt	lb.	3.00@3.25
Magnesium, ingots, 99 per cent	lb.	1.00@1.05
Platinum	oz.	$118.00
Iridium	oz.	2.75@3.00
Palladium	oz.	55.00@60.00
Mercury	75 lb.	67.00

Industrial

Financial, Construction and Manufacturers' News

Construction and Operation

Alabama

BIRMINGHAM—The Phœnix Portland Cement Co., Real Estate Trust Bldg., Philadelphia, Pa., with cement mill at Nazareth, Pa., has taken title to a tract of property at North Birmingham, totaling about 70 acres, heretofore held by the Sloss-Sheffield Steel & Iron Co., as a site for a new plant. Plans are being completed and a portion of the primary equipment ordered. Work will be placed under way on the initial buildings at an early date. The mill will have a capacity of about 1,500,000 bbl. of cement per year, and is estimated to cost in excess of $2,000,000, complete. Lindley C. Morton is president, and R. S. Scott, consulting engineer in charge.

TARRANT CITY—The Alabama Byproducts Co. has construction in progress on an addition to its byproducts coke plant, to increase the capacity close to 50 per cent. The new units will be placed in service at the earliest date.

Arizona

AJO—The New Cornelia Co. is perfecting plans for the construction of a new flotation plant at its local copper properties. Work will be commenced at an early date.

Arkansas

VAN BUREN—The Van Buren Glass Co., recently organized, has arranged to take over the plant of the Arkansas Products Co., which has been closed for about a year past, and which previously was devoted to the manufacture of glass tubing, etc. The new owner will remodel and improve the works, and plans to resume production at an early date. A new line of glassware will be manufactured at the plant.

California

NEVADA CITY—W. F. Heffinger and A. A. Tibbe, both of Oakland, Calif., are organizing a company to manufacture oil products, with pine needle extraction the primary basis of production. Negotiations are under way with the Chamber of Commerce, Nevada City, for a site for the proposed new mill. A selection will be made at an early date, and plans prepared.

Florida

JACKSONVILLE—The Kreiss Process Products Co., recently organized with a capital of $750,000, to manufacture potassium phosphate, etc., has preliminary plans in progress for the erection of a local plant, to be equipped for a monthly output of about 4,000 tons. It is estimated to cost approximately $75,000, including equipment. E. R. Taber is president, and Charles N. Weishans, secretary and treasurer.

Georgia

MCINTYRE—The Walden & Massengill Co., recently organized to operate a kaolin mine in this section, has tentative plans under consideration for the installation of a refining plant in the near future. H. A. Walden and C. G. Messengill head the company.

ATLANTA—The I. V. Sutphin Paper Co. has preliminary plans under way for the rebuilding of the portion of its local building, recently damaged by fire.

SAVANNAH—The Western Paper Makers' Chemical Co., Kalamazoo, Mich., with branch plants at Pensacola and Jacksonville, Fla., is reported to be planning for the establishment of a new paper mill in the vicinity of Savannah, with adjoining works for resin refining. The company is capitalized at $1,000,000, and recently acquired the properties of the Grecian-American Turpentine Co. in this section.

Illinois

JOLIET—The Illinois Wall Paper Co., affiliated with the York Card & Paper Co., York, Pa., Robert D. McCoy, president, has excavations under way for the construction of a new 1-story plant on Logan St., to be 100x300 ft., and estimated to cost about $75,000. R. C. Hoen, National Bank Bldg., Joliet, is architect.

Indiana

CARBON—The Carbon Firebrick & Coal Co. has completed plans for the erection of an addition to its local firebrick and refractory plant, to cost about $130,000, including machinery. E. E. Dean is president.

JEFFERSONVILLE—The Falls City Hydraulic Brick Co. is perfecting plans for the immediate installation of new equipment at its plant. A new kiln will also be constructed. Robert Akers is superintendent.

Kansas

ELDORADO—The Lewis Co. has commenced the construction of a new gasoline absorption plant in the Molter district. The plant will be equipped to handle about 5,000,000 cu.ft. of gas per day, with output averaging from 1 to 3 gal. per 1,000 cu.ft.

Louisiana

ELIZABETH—The Calcasieu Paper Mfg. Co., recently organized with a capital of $250,000, has plans under way for the erection of a new mill on local site for the production of kraft paper. A plant unit will also be installed for the production of tissue paper, with initial output approximating 10 tons per day. The project will include a byproducts plant for the recovery of turpentine and resin. The works will cost close to $150,000. R. M. Hallowell is president.

KENTWOOD—The local Chamber of Commerce has negotiations under way for the establishment of a new paper mill. A company will be organized to operate the plant. C. A. Kent, Sr., president of the Chamber of Commerce, is interested in the project.

Maine

WOODLAND—The St. Croix Paper Co. is reported to be planning for the rebuilding of the portion of its mill at Woodland Junction, recently destroyed by fire with loss of about $40,000.

Massachusetts

LEE—The Mountain Mill Paper Co. has commenced the erection of an addition to its mill at East Lee, comprising a main 1-story building, 40x150 ft., estimated to cost close to $60,000. It is planned to install equipment at an early date.

Michigan

KALAMAZOO—The Council is having plans prepared for the construction of a new municipal gas works, comprising six buildings, estimated to cost close to $2,000,000, including machinery. Burns & McDonnell 402 Interstate Bldg., Kansas City, Mo., are engineers. C. L. Miller is city manager.

JACKSON—The J. & S. Plating Co. has arranged for the establishment of a new metal plating plant at 112 East Washington St., and plan to commence operations at an early date. George J. Sights is general manager.

MUSKEGON—The Campbell-Wyant-Cannon Foundry Co., operating a foundry at Muskegon Heights, has perfected plans for the establishment of a large foundry in Muskegon proper, and will commence production at an early date. It is expected to provide facilities to give employment to a working force of about 1,000 men during the next few months. Frank E. McKee is vice-president.

New Jersey

GLOUCESTER—The Hinde & Dauch Paper Co., manufacturer of corrugated paper products, will soon commence the erection of an addition to its local mill, 1-story, 60x140 ft., to be used for increased capacity in the taping, slitting and affiliated departments.

WHIPPANY—R. B. McEwan & Sons are arranging for the rebuilding of the portion of their local paperboard mill, destroyed by fire, Aug. 30, with loss estimated at about $25,000. The fire originated in the boiler plant.

New Mexico

HILLSBORO—The Bonanza Mine is planning for improvements in its milling plant, including repairs to machinery, new operating equipment, etc., and purposes to place the mill in service at an early date.

New York

BUFFALO—The Angola Tire & Rubber Co., 270 North Division St., has awarded a contract to John A. Zoll, 398 Bird Ave., for the erection of a 1-story addition to its plant, 30x80 ft.

TONAWANDA—The J. Spaulding & Sons Co., 484 Broome St., New York, manufacturer of fiber products, has commenced the erection of a new 1- and 2-story addition to its plant at Tonawanda, 60x200 ft. and 100x300 ft., respectively, for general increase in production. The structures will cost about $250,000, including machinery. George F. Hardy, 309 Broadway, New York, is engineer.

North Carolina

BADIN—The Tallahassee Power Co. is planning for the installation of additional equipment at its local aluminum refining plant.

FLETCHER—George C. Sheehan, Asheville, N. C., is organizing a company to construct and operate a local brick and clay products manufacturing plant. A site totaling over 75 acres of land, including extensive clay deposits, has been acquired. The initial works are estimated to cost about $60,000.

Ohio

AKRON—Fire, Sept. 5, destroyed the plant of the Leo Meyer Co., North and Furnace Sts., comprising a 2-story building, equipped for rubber reclaiming operations, with loss estimated in excess of $80,000, including machinery. It is said that the plant will be rebuilt.

MIDDLETOWN—The Gardner-Harvey Paper Co., has awarded a contract to the F. H. Vaughn Building Co., Hamilton, O., for the erection of a new 1-story and part basement plant addition, 200x400 ft., estimated to cost close to $150,000. The plant will be used primarily for the manufacture of boxboard specialties, with machinery installation estimated to cost in excess of $30,000. Thomas H. Scott, P. A. Sorg Bldg., Middletown, is architect. E. T. Gardner is president.

YOUNGSTOWN—The Youngstown Steel Co. will soon commence the erection of a new mechanically operated puddling plant. It is expected to have the mill ready for service early in the coming year.

Oklahoma

DEWAR—The United States Zinc Smelting Co. is planning for the rebuilding of the portion of its local mill, including crusher and mixer rooms recently destroyed by fire, with loss reported at about $17,000.

ADA—The Choctaw Cotton Oil Co. has acquired the cottonseed oil mills of the Osage Cotton Oil Co., consisting of a number of plants in Oklahoma, Louisiana, Arkansas and Florida. The new owner will make a number of improvements and extensions in a number of the mills. A total of 26 oil mills, 1 oil refinery and 1 lard compounding plant will be operated. J. F. Phillips is president, and P. A. Norris, general manager.

Oregon

SALEM—The Oregon Pulp & Paper Co. has awarded a general contract to C. Van Patten & Son, Salem, for the erection of a new plant unit, consisting of a 4-story, reinforced-concrete mill, 75x80 ft., estimated to cost about $300,000, including machinery. Work will be placed under way at an early date. Knighton & Howell, United States Bank Bldg., Portland, are architects.

Pennsylvania

KITTANNING—The Kittanning Limestone Co. will soon take bids for the erection of a new 2-story building at its plant, 25x100 ft.

BRACKENRIDGE—The Atlantic Bottle Co., 90 West Broadway, New York, is said to have tentative plans under consideration for the rebuilding of the portion of its local glass manufacturing plant, destroyed by fire, Aug. 28, with loss estimated at about $300,000, including equipment.

YORK—The Gilbert Wall Paper Co., 733 Linden Ave., has plans under way for the

erection of a new plant at State St. and the Pennsylvania Railroad. J. A. Dempwolf, Casset Bldg., is architect. Paul J. Gilbert is president.

JOHNSONBURG—The Kistler Leather Co., 319 A St., Boston, Mass., has preliminary plans under consideration for the rebuilding of its local leather plant, known as the Rolfe Tannery, recently destroyed by fire, with loss estimated at about $150,000, including equipment.

PITTSBURGH—The Keystone Hair Insulating Co., 1243 Spring Garden Ave., will commence the immediate erection of a 1-story addition to its plant to cost about $42,000. Plans have been filed.

PHILADELPHIA—The Alemite Grease Cartridge Co., New York, represented by Charles M. Russell, 50 Church St., recently organized with a capital of $500,000, to manufacture lubricating greases, etc., has work under way on the establishment of a local plant, to be equipped for an initial capacity of about 20,000 grease-filled cartridges per day. The company is headed by C. E. Roberts and E. C. Landgren.

Tennessee

KNOXVILLE—The Knoxville Gas Co. is planning for extensions and improvements in its plant, including the installation of new equipment, estimated to cost close to $200,000. Alfred W. Young is president.

NASHVILLE—The Federal Chemical Co. is said to be planning for the rebuilding of the portion of its local acid works, destroyed by fire, Aug. 28, with loss estimated in excess of $150,000.

Texas

HOUSTON—C. A. Benton, 720 Oxford St., Montrose, Houston, has plans under way for the establishment of a new plant for the manufacture of pressed brick and other burned clay products. A list of equipment for installation will be arranged at an early date. A site for the plant has been selected.

ODESSA—A. P. Jordan, Winters, Tex., has organized a company to construct and operate a plant near Odessa for the manufacture of gypsum wall plaster. A complete refinery will be installed, with equipment to provide for an initial output of about 70 tons of plaster per day. A site for the mill, including raw material deposits adjoining, has been acquired. The plant is estimated to cost close to $40,000.

ROBSTOWN—W. C. Craig, Brownsville, Tex., is perfecting plans for the establishment of a local plant for the manufacture of brick and kindred burned clay products. A site has been secured.

WICHITA FALLS—The Empire Gas & Fuel Co., operated by the Cities Service Co., 60 Wall St., New York, has acquired the plants and oil properties of the Planet Petroleum Co., comprising more than 200 acres of land in the Electra and South Electra fields, for a consideration said to be about $3,000,000. The present leases and works have a daily output of about 5,000 bbl., and the new owner plans for enlargements and improvements.

Utah

SALT LAKE CITY—The Utah Oil Refinery Co., a subsidiary of the Midwest Refining Co., operated by the Standard Oil Co. of Indiana, Indianapolis, has plans in progress for the erection of an addition to its local oil-refining plant, to increase the capacity from 5,000 to 6,000 bbl. of crude oil per day. Two new crude oil stills, 3 high-pressure stills and auxiliary equipment will be installed.

Capital Increases, Etc.

THE CAYUGA ROCK SALT CO., Harrisburg, Pa., has filed notice of increase in capital from $500,000 to $800,000, for general expansion.

THE PITTSBURGH CRUCIBLE STEEL CO., Empire Bldg., Pittsburgh, Pa., has arranged for a bond issue of $150,000, for general operations, expansion, etc.

THE ATLANTIC DRIER & VARNISH CO., 57 Front St., New York, N. Y., manufacturer of varnishes and other paint products, has arranged for an issue of 5,000 shares of preferred stock and 10,000 shares of common stock, the proceeds to be used for general expansion.

ALEXANDER SEIDLER, INC., Newark, N. J., recently organized with a capital of $500,000, to manufacture chemicals, chemical by-products and affiliated specialties, will form a consolidation of the Alexander Seidler Co., 2 Orange St., and the Meyer & Carmody Import Co., both of Newark. The merged organization will extend its line of production. Alexander Seidler is president.

THE GENERAL PETROLEUM CORP., 71 Broadway, New York, is disposing of a note issue of $5,000,000, the proceeds to be used in part for general operations and proposed expansion.

THE TARX CHEMICAL CO., Chicago, Ill., has added 2,000 shares of stock, no par value, to its capitalization of $25,000, for proposed expansion.

THE ATLAS POWDER CO., 200 5th Ave., New York, has disposed of a stock issue of $4,080,000, a portion of the proceeds to be used for general operations, financing, etc.

THE EASTERN STRAWBOARD CO., Manchester, Conn., has filed notice of dissolution under state laws.

THE W. S. ALLING RUBBER CO., Norwich, Conn., has filed notice of increase in capital from $200,000 to $350,000.

Industrial Developments

GLASS—The Macbeth-Evans Glass Co., Pittsburgh, Pa., is arranging for the immediate resumption of production in the idle portion of its plant at Elwood, Ind., comprising one complete plant unit. This will place the works on a capacity basis for the first time in a number of months. Additions will be made to the working force.

The Wichita Falls Window Glass Co., Wichita Falls, Tex., is planning for the reopening of its plant early in October, following a curtailment of a number of months. It is said that the works will return to hand-blowing method of production, discarding the automatic process. Improvements will be made.

Glass factories at Millville, N. J., giving employment to a total of about 3,000 operatives, are delaying the resumption of production owing to difficulty in securing fuel. A number of plants purpose to install oil furnaces unless the situation improves.

Owing to car shortage, the Pennsylvania Glass Sand Co., has been compelled to curtail operations at its Keystone Works, Mapleton, Pa. It is expected to resume capacity production at an early date.

CERAMIC—The West Branch Brick Works, Renovo, Pa., has resumed production at its local plant, following a period of curtailment. It is expected to increase the present working force in the near future.

The Harbison-Walker Refractories Co., Pittsburgh, Pa., is maintaining capacity production at its plants at Flemington, Mill Hall and Farrandsville, Pa., with full working forces. An effort is being made, it is said, to obtain additional employees at the plants. Wages have been advanced from 6 to 10 cents an hour.

The Frankford Brick Co., Philadelphia, Pa., has adopted a production schedule of 35,000 bricks a day, and expects to maintain this basis for an indefinite period.

A number of brick plants in Eastern Carolina districts have been forced to suspend production on account of the railroad strike and fuel shortage.

LEATHER—The Standard Kid Co., Wilmington, Del., specializing in the manufacture of glazed kid, has adopted a production schedule of about 80 per cent of capacity, and has sufficient orders on hand to maintain this basis for a number of months to come.

Hide tackers at the plant of the A. C. Lawrence Leather Co., Peabody, Mass., have made a wage demand from 11½ to 12½ cents per hide. The men have been averaging from $35 to $44 a week, and ask for $50 average per week.

The New Castle Leather Co., Wilmington, Del., is operating at about 75 per cent of full capacity, and will maintain this schedule for an indefinite period.

The Beadenkopf Leather Co., Wilmington, Del., has resumed operations at its local plants, and plans to increase the present production schedule in the near future.

Robert Foerderer, Inc., Philadelphia, Pa., manufacturer of patent leather, has adopted a capacity production basis at its tannery. The plant was forced to curtail recently due to a shortage of raw skins.

IRON AND STEEL—The Replogle Steel Co., Dover, N. J., is arranging to blow in another blast furnace at its Wharton plant. Wages have recently been advanced 5 cents an hour at the mills. The iron ore properties of the company at Mount Hope have been reopened, giving employment to about 400 men.

The Bethlehem Steel Co., has blown in another furnace at its plant at Steelton, Pa. An additional battery of coke ovens has also been started.

The Lukens Steel Co. is maintaining active production at its Coatesville, Pa., plant, used for the manufacture of steel sheets, giving employment to close to 3,000 men. Wages have been advanced from 25 to 30 cents an hour, effective Sept. 15.

The Shenango Furnace Co., Sharpsville, Pa., has blown in its local blast furnace, following a shut-down for about 5 weeks.

The Valley Mould & Iron Co., Youngstown, O., has resumed operations at its plant, following a recent curtailment due to coal and coke shortage.

The American Rolling Mill Co., Middletown, O., is maintaining active production at its plant, giving employment to a full working force in the majority of departments. Wages of laborers have been advanced 6 cents an hour, and proportionate increases have been made in the wages of other operatives. Salaried employees have been granted a 10 per cent advance.

The Gulf States Steel Co., Birmingham, Ala., has adopted a double working shift at its 13-in. mill at the Gadsden, Ala., steel works. The 20-in. mill has recently been placed in operation for the first time since 1920.

The Glasgow Iron Co., Pottstown, Pa., is running full at its local mills, and has advanced the puddling rate from $7 to $8 a ton. Laborers have been granted an increase of from 27½ to 30 cents an hour.

The Colorado Fuel & Iron Co., Pueblo, Colo., has resumed operations in all departments with the exception of the rail mill, following a curtailment for a number of weeks. Wages of all classes of employees at the plant have been increased.

MISCELLANEOUS—The Bethlehem Spark Plug Co., Bethlehem, Pa., manufacturer of porcelain spark plugs, is operating its plant at capacity, with two departments working on a 14-hour day basis.

The Electric Hose & Rubber Co., Wilmington, Del., manufacturer of heavy rubber products, has advanced production to include a night shift in addition to regular day operation. Additional operatives are being employed.

The United States Industrial Alcohol Co., New York, has advanced production to a capacity schedule at its three plants at New Orleans, La., which have been running on a half-time basis for a number of months past. Employment will be given to about 500 men.

Owing to the high cost of coal, ranging from a former basis of $4 a ton to a present rate of $11 a ton, the Durex Chemical Co., Sweetwater, Tex., has closed down its local plant, used for the manufacture of barium compounds, for an indefinite period.

The Traveler Rubber Co., Bethlehem, Pa., has adopted an operating schedule of 450 automobile tires a day, as compared with about 75 tires daily at this time last year. The plant is giving employment to about 160 men, and has orders on hand to insure the present basis of production for a number of months to come.

The Exeloid Co., Stroudsburg, Pa., manufacturer of celluloid toys and kindred products, is planning for the reopening of its local plant, following a shut down for some time past.

New Companies

THE BELLBY NATURAL GASOLINE CO., Wichita Falls, Tex., has been incorporated with a capital of $150,000, to operate a gasoline refining plant. The incorporators are J. F. Darby, O. J. McKnight and W. K. Campbell, all of Wichita Falls.

THE TRINITY PAPER MILLS CORP., care of Boyce & Magee, Dover, Del., representatives, has been incorporated under state laws with a capital of $6,000,000, to manufacture paper and pulp products.

THE VELVETONE PRODUCTS CORP., New York, N. Y., care of J. J. Ryan, 355 East 149th St., New York, representative, has been incorporated with a capital of $10,000, to manufacture polishes, etc. The incorporators are J. and D. S. Rouse, and S. K. Haines.

THE ARKANSAS HOMESTEAD OIL CO., Fort Smith, Ark., has been incorporated with a capital of $100,000, to manufacture petroleum products. The incorporators are Stephen Gilbert, Charles Clark and Hugh Johnson, all of Fort Smith.

THE GEES-HAMMOND CO., Springfield, Mo., has been incorporated with a capital of $100,000, to manufacture soaps and kindred products. The incorporators are John J. Gees and J. M. Hammond, both of Springfield.

THE SUPERIOR MAGNESITE PRODUCTS CO., Escanaba, Mich., has been incorporated with a capital of $25,000, to manufacture magne-

site specialties. The incorporators are P. L. Sullivan, E. W. Sivertsen and W. J. Clark, all of Escanaba.

THE R. E. CARPENTER CO., Henry St., Elizabeth, N. J., has been incorporated with a capital of $50,000, to manufacture chemical products. The incorporators are Stephen France, A. Vance Pierson and William R. Morris, all of Elizabeth.

THE STANDARD ENAMELING & MFG. CO., Camden, N. J., care of A. Moulton McNutt, 207 Market St., representative, has been incorporated with a capital of $125,000, to manufacture enameled products. The incorporators are Orlando S. Watts, John Predow and Morris Redl, all of Camden.

M. L. ULLMAN, INC., New York, N. Y., care of Sigmund Honig, 799 Broadway, representative, has been incorporated with a capital of $20,000, to manufacture chemicals and affiliated products. The incorporators are C. H. Halper, L. Arnoff and M. L. Ullman.

THE FIBRE PRODUCTS CO., Boston, Mass., has been incorporated with a capital of $100,000, to manufacture fiber goods. Arthur N. Rice, 4 Liberty Square, Boston, is president and treasurer.

THE ARLINGTON PAINT & VARNISH CORP., care of the Corporation Trust Co. of America, du Pont Bldg., Wilmington, Del., representative, has been incorporated under state laws with a capital of $7,500,000 to manufacture paints, varnishes, stains, etc.

THE CALDWELL OIL & REFINING CO., Louisville, Ky., has been incorporated with a nominal capital of $5,000, to manufacture refined petroleum products. The incorporators are Farley M. Caldwell, William Yentch and R. Sterling Sanford, all of Louisville.

THE COLUMBIA BRICK CO., East Orange, N. J., has been incorporated with a capital of 5,000 shares of stock, no par value, to manufacture brick and kindred burned clay products. The incorporators are Richard and Daniel Reagan, Washington St., East Orange.

THE PROGRESSIVE FOUNDRY CO., Rochester, N. Y., care of Crittenden & Crittenden, Powers Bldg., representative, has been incorporated with a capital of $100,000, to manufacture iron, steel and other metal castings. The incorporators are P. Bittner, C. Bennett, and C. Hobbing.

THE EUREKA CHEMICAL CO., Boston, Mass., has filed notice of organization to manufacture chemicals and chemical byproducts. The company is headed by Vincent Ambrosiano, 104 London St., East Boston.

THE KLEN-ZIT MFG. CO., Portland, Me., has been incorporated with a capital of $50,000, to manufacture chemical specialties. E. Sturdivant is president, and H. P. Sweetser, Portland, treasurer. The last noted represents the company.

THE OTSTOT DEVELOPMENT CO., Blackwell, Okla., care of the Corporation Service Co., Equitable Bldg., Wilmington, Del., representative, has been incorporated with a capital of $250,000, under Delaware laws, to manufacture petroleum products. The incorporators are R. Otstot, Edward Shaft, Blackwell; and T. K. Vance, Enid, Okla.

THE HOOSIER FERTILIZER CO., 1400 North Halsted St., Chicago, Ill., has been incorporated with a capital of $40,000, to manufacture fertilizer products. The incorporators are Samuel L. Sarnatzky and Barnard Margolis.

THE MILNE FOUNDRY CO., Schenectady, N. Y., care of L. W. Block, Albany, N. Y., representative, has been incorporated with a capital of $100,000, to manufacture iron, steel and other metal castings. The incorporators are W. H. Milne, J. E. Laurie and G. C. Ratchford, all of Schenectady.

THE ORRITE CO., Nashville, Tenn., has been incorporated with a capital of $200,000, to manufacture composition stone and other composition products. The incorporators are W. H. Millard, Arthur W. Vantrease and King Sparks, all of Nashville.

THE SALEM FIBRE PRODUCTS CO., Salem, Mass., has been incorporated with a capital of $25,000, to manufacture fiber specialties. Everett B. Cook, Salem, is president; and Jennie O. Cook, Beverly, Mass., treasurer. The last noted represents the company.

THE GYPSUM ENGINEERING & MFG. CO., Room 717, 111 West Washington St., Chicago, Ill., has been organized under state laws to manufacture gypsum specialties, and magnesite byproducts. The incorporators are Willard L. King, Sanson Gusdorf, and Robert I. Rheinstrom.

THE STICKEL-HEFFER YEAST CO., Bedford Park, N. J., has been incorporated with a capital of $500,000, to manufacture yeast and kindred products. The incorporators are C. H. Hepfer, Herman Abbenseth and John Stickel, Mill St. and Willett Ave., Bedford Park. The last noted represents the company.

DYES & CHEMICALS, INC., Montclair, N. J., has been incorporated with a capital of $150,000, to manufacture chemicals, chemical byproducts, dyes, etc. The incorporators are Lennox C. Brennan, William H. Orr and Francis Earle, 120 Highland Ave., Montclair. The last noted represents the company.

THE ORIOLE PETROLEUM CORP., care of the Corporation Service Co., Equitable Bldg., Wilmington, Del., representative, has been incorporated with a capital of $100,000, under Delaware laws, to manufacture oil products.

THE HOFFMAN CHEMICAL CO., Brooklyn, N. Y., care of J. A. McNamara, 165 Broadway, New York, representative, has been incorporated with a capital of $50,000, to manufacture chemicals and chemical byproducts. The incorporators are D. J. Murphy, J. M. McNamara and T. P. Mackey.

THE TARVER BROTHERS PETROLEUM CORP., Houston, Tex., has been incorporated with a capital of $100,000, to manufacture oil products. The incorporators are G. B. Outlaw, J. B. Warren, and J. D. Tarver, all of Houston.

THE OPEN-HEARTH FIREBRICK CO., care of the Delaware Incorporating Co., Wilmington, Del., representative, has been incorporated under state laws with a capital of $5,500,000, to manufacture firebrick and other refractory products.

THE WATERMAN OIL CO., 2nd St., Waterman, Ill., has been incorporated with a capital of $5,000, to manufacture oil products. The incorporators are C. W. Smith, H. Roberts and A. R. Wollenweber, all of Waterman.

THE WILKINSON GUANO CO., Spartansburg, S. C., has been incorporated with a capital of $25,000, to manufacture fertilizer products. Floyd T. Smith is president; and J. C. Wilkinson, vice-president, both of Spartansburg.

THE SERVO SALES CORP., Brooklyn, N. Y., care of J. A. McNamara, 165 Broadway, New York, representative, has been incorporated with a capital of $50,000, to manufacture chemical products. The incorporators are D. J. Murphy and T. P. Mackey.

THE CODDE BRASS & ALUMINUM CO., 1006-7 Hammond Bldg., Detroit, Mich., has been incorporated with a capital of $30,000, to manufacture brass, aluminum, bronze and other metal products. The incorporators are Mayer C. Brown and Harry A. Codde.

THE TEX PRODUCTS, INC., Brooklyn, N. Y., care of S. Rosenfeld, 808 Broadway, Brooklyn, representative, has been incorporated with a capital of $50,000, to manufacture cleansing powders, chemical specialties, etc. The incorporators are H. Pearlman, and H. F. Pearsall.

THE EASTLAND PIONEER OIL REFINING CO., care of the Corporation Trust Co. of America, du Pont Bldg., Wilmington, Del., representative, has been incorporated under Delaware laws with a capital of $1,000,000, to manufacture refined petroleum products.

THE UNITED STATES LEAD CO., 237 Baldwin Ave., Jersey City, N. J., has filed notice of organization to manufacture white lead and kindred products. Alfred J. Parker heads the company.

Industrial Notes

THE SCHEID ENGINEERING CORP., 90 West St., New York City, has been appointed metropolitan and export representative for the Franklin Moore Co., Winsted, Conn., manufacturer of material-handling machinery for industrial plants.

THE NATIONAL CARBON CO., in order to reduce the time required for handling small and other emergency requirements of carbon brushes and to give better service to its customers, has established two finishing plants, one located at 337 East 41st St., New York, and the other at 560 West Congress St., Chicago. These supplement the emergency department maintained for some time at the Cleveland factory. Both of these plants carry complete stocks of all leading grades of Columbia carbon, graphite and metal graphite brushes, and are prepared to furnish all sizes equipped with standard types of shunt connections, or other special methods of finishing. The same standards of workmanship and the same close attention to and inspection of detail as obtained in the larger brush plants of the company are strictly obsered in these small plants. Necessarily the capacity of these plants is limited and it is the desire of the company that, where delivery conditions will permit, orders for material of this kind be forwarded to Cleveland, O., as in the past. However, on breakdown jobs and other requirements of an emergency nature, the users of brushes in the surrounding territories should avail themselves of the special facilities at New York, Cleveland and Chicago, and should send their orders to the nearest plant.

On Aug. 1 the SCHAEFFER & BUDENBERG MFG. CO. acquired the business and good will of the American Steam Gauge & Valve Mfg. Co. of Boston, Mass., and is operating it as a division of its own business, with headquarters and sales department located at 338 Berry St., Brooklyn, N. Y.

THE NELSON VALVE CO. announces that its office at 90 West St., New York City, is now under the management of Walter S. Dickson, who is in charge of the New York district and export departments.

THE CHICAGO FLEXIBLE SHAFT CO., Chicago, Ill., announces that the address of its New York office, of Stewart industrial furnaces, which has been located at 350 Broadway since it was established early in 1920, has been changed to 16 Reade St. The office, as before, is in charge of J. W. Lazear.

THE CLEVELAND COOPERAGE CO., Cleveland, O., has taken over the manufacture and sale of a rubber-lined barrel originally invented by James H. Gravell, president of the American Chemical Paint Co., and used in carrying the production of that company. The new Lastik barrel is used for the transportation of acids, extracts, tinctures, oils, varnishes and chemicals.

THE DARCO SALES CORP. has announced the appointment of Jayne & Sidebottom, Inc., 17 Battery Place, N. Y., as its sole selling agent in the New York metropolitan district and the State of New Jersey, for Darco decolorizing carbons.

THE PENNSYLVANIA PUMP & COMPRESSOR CO., Easton, Pa., announces that James A. Beaubien, formerly vice-president and general manager of the Weber Subterranean Pump Co., is now manager of its New York office at 30 Church St.

THE HEYDEN CHEMICAL CO. of New York City has elected Bernard R. Armour president. F. H. Chamberlain, formerly president, will continue as chairman of the board of directors. George L. Armour has been elected treasurer, and James Branegan has been re-elected vice-president. George F. Lewis will retain his connection with the company for the present as secretary. William Weckman has been elected assistant secretary.

THE FOAMITE-CHILDS CORP. is the name of the company representing the consolidation of the Foamite Firefoam Co. of New York and the O. J. Childs Co., Inc., Utica, N. Y., both of which handle complete fire-protection service. The following officers were elected: W. J. Childs, president; F. M. Watters, vice-president; E. Janeway, secretary, and F. J. Maginniss, treasurer. James C. Patterson will continue as a director in full charge of sales. It has been announced that there will be no change in the sales policies of the consolidating companies. Executive offices are located at Utica, N. Y.

THE WALKER CHEMICAL CO. and the SELDEN CO. of Pittsburgh, Pa., have been consolidated into one concern and the business of both companies will be carried on in the name of the Selden Co. No change of any kind has been made in either the personnel or management.

Coming Meetings and Events

AMERICAN ELECTROCHEMICAL SOCIETY will hold its fall meeting in Montreal, Sept. 21, 22 and 23. Headquarters will be at the Windsor Hotel.

AMERICAN GAS ASSOCIATION will hold its annual convention and exhibition at Atlantic City, Oct. 23 to 28.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS will hold its 126th meeting at San Francisco, Calif., Sept. 25-29, 1922.

AMERICAN SOCIETY FOR STEEL TREATING will hold its International Steel Exposition and Convention in the General Motors Bldg., Detroit, Mich., Oct. 2 to 7.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING will be held at the Grand Central Palace Dec. 7-13, with the exception of the intervening Sunday.

NEW JERSEY CHEMICAL SOCIETY has discontinued meetings for the summer, but will resume them in October.

SOCIETY OF INDUSTRIAL ENGINEERS will hold a 3-day national convention in New York, beginning Oct. 18. The general topic of the convention is "Economics of Industry."